Light and Lighting

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Taxes upon Light

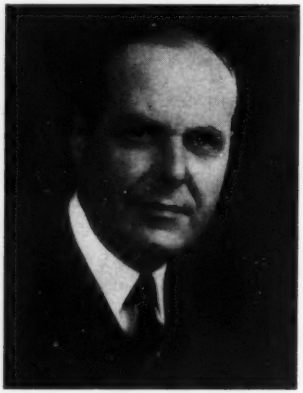
A CENTURY ago there was still a tax upon windows, though increasing public pressure on the Government was soon to force its abolition. The bricked-up window spaces to be seen in some surviving dwellings dating from the window tax era as well as the inadequate windows in others which exhibit no such architectural shams, still bear witness to the unfortunate effects of this tax. Not very long after the window duties were abolished a Chancellor of the Exchequer, seeking for new sources of revenue as is the perennial habit of our Budget devisers, proposed to put a tax upon the humble lucifer. To-day, though daylight-sources are no longer dutiable, artificial light-sources have replaced them as prey for the tax-gatherer. For every lamp we buy to give us needful artificial light we must pay purchase tax, and the more light the lamp gives the greater the tax. Moreover, the tax per lumen is much higher if we get our light from fuel-economising fluorescent lamps than if we get it from less efficient lamps. To tax efficiency is surely fiscal folly, and to tax us if we wish to see at all at night is one of the least defensible of budgetary devices. While good lighting is thus penalised, public money flows freely so that those who might see well enough with it shall have glasses in substitution.

Notes and News

Honorary Membership of I.E.S. for Ward Harrison

Under the terms of its constitution the Illuminating Engineering Society is entitled to elect to Honorary Membership anyone who is of acknowledged eminence in some branch of science relating to illuminating engineering or who by reason of position, eminence or experience has greatly assisted in promoting the objects of the Society.

The distinction of Honorary Membership, the highest honour the I.E.S. have to bestow, has throughout the whole forty or so years of the Society's existence been awarded only three times. The Society is permitted by regulation to have not more than six such members at any one time and to appoint not more than one in any year. Past holders of this distinction were A. P. Trotter and J. S. Dow; the only present holder is Howard Long. It is now announced that in recognition of his long services to illuminating engineering the Society have conferred Honorary Membership on Dr. Ward Harrison of the United States.



Ward Harrison.

Dr. Harrison has been active in illuminating engineering work since 1909 when, after graduating from the Stevens Institute of Technology, he entered the employ of the General Electric Company of the U.S.A. He recently retired from that organisation after having been Director of Engineering for the Lamp Department at Nela Park since 1930. It was mainly in connection with his work at Nela Park that Ward Harrison was known personally to so many lighting engineers in this country; his kind reception of and hospitality to visitors to his laboratories made a call to Nela Park one of the highlights of a visit to the United States.

In the early days of illuminating engineering Ward Harrison in conjunction with Earl Anderson devised the co-efficient of utilisation method which is now employed almost universally in illumination design calculations. Of recent years Dr Harrison devoted much of his time in an endeavour to establish a system of numerical glare ratings by which it should be possible to predetermine the quality of a lighting installation from the comfort standpoint just as the illumination can be accurately predicted by means of the co-efficient of utilisation method.

Dr. Harrison has for many years taken a leading part in the activities of the American Illuminating Engineering Society of which he is a Past-President and a Fellow. In 1940 he was awarded the Honorary Degree of Doctor of Illuminating Engineering by the Case Institute of Technology. He will probably be best remembered by members of the I.E.S. in connection with his visit to this country for the 1948 Summer Meeting at Harrogate where he gave an address entitled "Some Frontiers of the Lighting Art." All who were present at the Harrogate meetings have the happiest recollections of the kindness and charm of Dr. and Mrs. Ward Harrison.

There can be no doubt whatsoever of the high esteem with which Dr. Harrison is regarded in this country and the wisdom of the I.E.S. in awarding him the highest honour in their power will be applauded by all. On behalf of members of the I.E.S. and readers of this journal we convey to Dr. Harrison our sincerest congratulations.

Inadequate Hospital Lighting

Hospitals are not the most cheerful of places in any circumstances and, unfortunately, their artificial lighting is sometimes positively grim. At a recent meeting of the Orpington and Sevenoaks Hospital Management Committee, one of the members described lighting in the wards at Orpington Hospital as being "appalling." Patients, he said, were unable to see to read or knit. The Committee were considering a recommendation that fluorescent lighting be installed in each day-room at a cost of £200, but the outspoken member protested that the lighting of the wards was far more important and had been delayed too long. A report from the Hospitals Engineer stated that the installation of a sufficient number of additional light sources would mean overloading the feeder cable, and we wonder in how many other cases a similar difficulty is preventing much-needed improvement in the lighting of hospitals.

British Lighting Engineers meet in America

News reaches us of the activities of the two British lighting engineers who in recent years have resided across the Atlantic, one in New York, the other in Montreal. On February 27 Mr. R. G. Williams, formerly of Nottingham, read a paper on stage lighting at a joint meeting of the Montreal Section of the I.E.S. of America and the Western Quebec Drama League. In Montreal he discovered that one of those responsible for the arrangements for the meeting was Mr. R. A. Eshelby formerly of London and now with the Northern Electric Company. During the last few months Mr. Williams has addressed a number of I.E.S. meetings in the U.S.A.

The British Industries Fair

This year the British Industries Fair, perhaps the most important of all in view of the ever-increasing competition for world trade, was visited by thousands of overseas and home buyers.

As in previous years the Engineering and Hardware Section was held at Castle Bromwich, Birmingham, while the lighter products, including scientific instruments, were shown at Earls Court and Olympia. At Castle Bromwich the lighting exhibits ranged from street-lighting columns to decorative lighting fittings for domestic use, all of which were well displayed, the stands being up to the usual high standard. Working demonstrations seen included a scale model of aerodrome lighting based on the Calvert system and conforming to I.C.A.O. standards and recent recommendations. It appears that this particular model aroused great interest especially in those who advocate international standardisation of aerodrome lighting. An illustrated review of the lighting exhibits will be included in our next issue.

Light on the Local

A few months ago we commented in these columns on the use of our newer light sources for lighting in "pubs." We were very glad, therefore, to see that a special exhibition of designs for the public house of to-morrow was to be held in London recently, and we duly attended, hoping to see something pretty good. Alas, we were to be disappointed.

Few designers, whatever they may do to the shapes and sizes of other pieces of furniture, can think of any alternative to the flex dangling from the ceiling. And those who have advanced beyond the primitive stage seem to favour the most extraordinary pieces of equipment which look like collections of cuspidors on a Christmas tree.

An interesting example of the application of a louvrall ceiling in a small restaurant at Stratford Court, London.

Light in the Hotel

By E. B. SAWYER,*
F.I.E.S.

It is felt by many that lighting, in both the public and private rooms, in hotels in this country can be and should be improved not only for our own benefit, but also for the benefit of overseas visitors. It does not follow that good lighting is not to be found in any hotel in this country. It is thought, however, that the subject needs a special study.

As is well known, the major task before this country at the present time is to sell British goods for hard currency, and it is to this end that the 1951 Festival of Britain has been planned. Selling British goods, however, does not necessarily mean only visible exports but those as well which are less tangible, and, with the Festival year so very near the time is most opportune for considering British hotels and the contribution their efficiency and good management can make towards the successful operation of our chief dollar-earner—the tourist trade.

While the final picture should, of course, be one of all-round efficiency, there is no doubt that improved methods of lighting provide one of the most important ways of improving the appearance of hotels, and I therefore feel that it is quite justifiable to single out this amenity for particular consideration.

In discussing this subject, however, I find it difficult to avoid the temptation of taking up more space than I should in the defence of British hotels, for, compared with those in other countries, they are not so inefficient or badly lit as we are constantly led to suppose.

I am, indeed, inclined to feel that much of the criticism levelled at them to-day is some 20 years out of date or, at least, based on factors beyond the control of the hotelkeeper, for I can recall, better perhaps than some of their loudest critics, the improvements that took place before the war.

In those days I played some small part in the organisation of a nation-wide campaign to improve the standard of lighting in hotels, and in the course of this it was inevitable that I should become moderately conversant with the conditions then prevailing.

We found, for example, that floodlighting was conspicuous by its absence; that only a very small percentage of bedrooms could boast more than a single glaring light-source suspended in the vicinity of the window, and that even fewer had the convenience of two-way switching; that a suitable light for shaving was almost non-existent in either bedroom, bathroom or dressing-room; that in the public rooms the utility and decorative lighting bordered on the primitive and that, generally speaking, British hoteliers had very little idea of *using* light as a means of gaining friends and increasing business, but kept in the forefront of their minds the question of reducing its cost to the minimum as though it were nothing more than a rather disagreeable overhead expense.

As I have said, this knowledge came my way by reason of our efforts to improve hotel lighting before the war, and I feel it can truthfully be claimed that this campaign bore fruit. Even small boarding houses came within its scope, and in such districts as South Kensington and Bayswater in London, to say nothing of those seasonally prosperous seaside towns, it became the rule rather than the exception to see floodlighting and illuminated signs. Bedrooms, too, began to have two-way switching, and it was even possible to read with complete comfort in the public rooms, an indication that illumination values, if nothing else, had increased considerably.

While, therefore, not denying that much still remains to be done, it is with a certain feeling of injustice that I read to-day of the inferior British hotel, for I know full well that things are not as bad as they are so frequently made to appear. Certainly in the best hotels in Europe and America you will find "every modern convenience," but so you will in similar establishments in England, and, type for type, I am most reluctant to concede that, by comparison, we have any need to be ashamed.

This holds good even for America, and I feel sure that those who have been there recently will bear me out. All hotels there

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are *not* perfect. Admittedly, they have some services, notably in regard to laundry, that we could well do with, but in the essentials we can easily hold our own.

A sense of proportion is necessary if we are not to develop a bad national inferiority complex, and since, very fortunately, we are not able to offer the mysterious attraction of a foreign tongue to our American friends the question to my mind is not so much whether British hotels are as good as those in other countries but whether they are sufficiently better.

We know that of two shops selling the same goods and facing each other in the same street the one with the best display and the best lighting will get more business than the other, and if hoteliers in this country wish to capture a larger proportion of the tourist trade of the world it is on that principle that they must work.

The hotel-keeper needs to be a good home maker and a good salesman and given these qualities good lighting, I feel, would naturally follow were it not for the question of cost, and it is, therefore, of the utmost importance that we do everything in our power to show the advantages better lighting can bring since, largely as a result of the war and the years of talk about economy, the old short-sighted ideas have been given a new lease of life in far too many instances.

Domestic comfort and good lighting are indivisible, and if we are to see British hotels recognised as the best in the world then it must be realised that an hotel lighting installation must cater for the continuance of a comfortable domestic existence as well as for more festive occasions.

Elaborate decorative installations are certainly desirable but they do not answer every need. In a lounge, for instance, the lighting most people appreciate is that which gives them a sense of privacy, that creates a patch of light around their particular group, and they like the light source to be near. They also like it to be movable and, despite objections to trailing "flex" which, incidentally, would be very much reduced with a proper installation of plug-points, I have yet to discover anything that meets more needs of almost every description than a solidly constructed floor-standard preferably of the American "bridge-lamp" type. In fact I believe that each public room should have two installations, one for the quiet evening, that is to say mainly for residents, and one for the cheerful party atmosphere.

Consider your own reactions and see if you do not agree with me. For a party, say, at Christmas you like to find an hotel as different from home as possible, indeed, your very reason for going there is more than likely to find a commercial glitter that you cannot economically create at home; but if you want to spend a few days by the sea, or even in London, with your family or friends, or need accommodation on a business trip, the more atmosphere of home you find the more pleasing it is.

A dual installation, I fully realise, means a heavier expenditure but it means as well more money gained and, what is more, constantly gained over a number of years. It is a capital investment paying a very high rate of interest and one which every hotelier who has a genuine and intelligent interest in his business cannot afford to forgo. Many hotels have made such an investment and have found it worth while. Many more would follow their example if owners and managers knew better what good utility and decorative lighting means. Ignorance there certainly is, but the root cause does not lie so much with the hotel-keeper as with an almost universal lack of appreciation in this country of what lighting can do and it is here that members of the Illuminating Engineering Society up and down the country can make their contribution towards improvements. By interesting themselves in the welfare of hotels in their localities, by organising meetings with imaginative speakers and inviting hotel personnel, they can assist in spreading a wider knowledge of up-to-date lighting ideas. I firmly believe that there is a genuine desire amongst British hotel-keepers to do everything in their power to please their guests and I feel sure that if we will only show them what they should do we can safely leave the rest to them.

Lighting may seem, or even be, of secondary importance compared with good food or sound sanitation but, as I said earlier, it is one of the most important ways of improving the appearance of an hotel as well as being an integral part of efficient service in all departments.

Good lighting is indisputably necessary and until it is to be found in all hotels it will make it difficult for us to be entitled to lay claim to that superiority in hotel accommodation that may well weight the balance of the tourist trade in favour of this country to the tune of many million dollars each year.

Lighting in a Haymarket Restaurant

The premises of the "Haywain" restaurant, previously known under another name, were recently completely remodelled and extended. The architect was C. Edmund Wilford, A.R.I.B.A.

Internally the premises are very long and narrow, as will be seen in the plan on this page. To avoid a tunnel-like effect the restaurant has been designed in three separate sections, each having a different treatment in design and lighting.

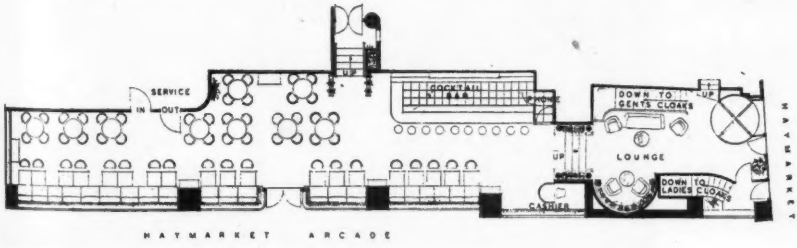
The main features of the entrance foyer are the semi-circular recess with a flower trough and the very large circular lighting fitting. This fitting, 7 ft. 6 in. in diameter, was specially designed by the general contractors, Heals Contracts, Ltd. It is made of anti-splinter netting of the type used during the war to cover glass windows. The illumination is from four 2-ft. 20-watt warm white fluorescent tubes and, in the centre of the fitting, from four 60-watt tungsten lamps. Semi-indirect ceiling lighting is provided by 10 spun-aluminium fittings of the ball and cup type, each housing 100-watt tungsten lamps.

From the entrance foyer four steps lead down into the cocktail bar and restaurant. This stairway is lighted by 5-ft. 80-watt "Mellow" lamps which are concealed in plaster coves.

The lighting in the cocktail bar is very effective. The general lighting is by circular louvred fittings flush with the ceiling, each containing a 60-watt tungsten lamp. It is interesting to note that four of these fittings are used in the ventilation system. Over the bar there is an illuminated laylight which consists of six warm white 5-ft. 80-watt fluorescent tubes and two anodised strip fittings each of which contains three double-ended 60-watt tubular lamps.

In the restaurant the existing ceiling was higher than that in the foyer and cocktail bar, so deep narrow beams of fibrous plaster construction were provided across the room

(Above). The entrance foyer showing the semi-circular recess with a flower trough and the unusual circular lighting fitting. *(Below).* Plan of the restaurant.



The cocktail bar lighted by an illuminated laylight.

at regular intervals; a space was left between the top of the beams and the existing ceiling to provide a more pleasing proportion. Concealed in the top of the beams are 26 peach-coloured fluorescent tubes in 4-ft. 40-watt units. However, this number of lamps was found to give too bright a light and so only 14 are now put into use. This is found to be quite sufficient and a pleasant diffused light throughout the restaurant is achieved.

The colour scheme of the restaurant is pale rose and ivory with the beams and their vertical wall ribs a pastel shade of grey. The plate glass windows facing the Haymarket Arcade are completely curtained, the curtains being illuminated from eight pelmet lights each containing one 4-ft. 40-watt peach-coloured fluorescent tube.

The total lighting load is just over 3,000 watts. The electrical installations were carried out by H. V. Stone and Co. of Paddington.

The restaurant, where the main lighting is concealed in the top of plaster beams. Note, too, the pelmet lighting.

Harmony of Lighting and Architecture

—Examples of Failure and Success

The need for co-operation between architect and lighting engineer cannot be overstressed. In this short article Grenfell Baines, A.R.I.B.A., A.M.T.P.I., describes his earliest attempt at designing an hotel interior and admits, quite frankly, that where he made mistakes in the lighting scheme it was due to his failure to consult a lighting engineer.

Lighting schemes for almost any part of an hotel may be designed with more emphasis on the decorative and architectural effect than the need to provide a high level of illumination; nevertheless the following experiences in hotel lighting serve to show that no one can afford to neglect to consider together all the principles of good lighting. May it be explained right away that in these instances the architect failed to consult a lighting engineer. The author confesses to being the architect, and pleads it was his first real job in practice.

It is not considered that both of the schemes illustrated were failures—on the contrary, one is described because it is believed to be a good example of lighting and architectural treatment being in harmony. The scheme which failed was that for the modernised saloon bar of a medium-sized Victorian "pub," the successful scheme was for the lounge.

During the process of lifting the face of the old building it was decided to lower the bar ceiling, and this presented a tempting opportunity to indulge in an essay in sunk panel lighting. Architecturally the panels were quite successful—they were of adequate

The lighting scheme that failed. A modernised saloon bar lighted by tungsten lamps housed in spun aluminium reflector fittings.

scale and sympathetically placed for decorative effect. It was known from the beginning that the amount and distribution of light would be questionable, but it was considered that the architectural effect was of overriding importance.

The panels were sunk in the ceiling to the depth of the construction, they were provided with polished spun aluminium reflectors and acid obscured glass panels; they began by being powered with 150-watt lamps, later 200-watt, and finally 300-watt. Provisions for easy cleaning and dissipation of heat were made, yet in spite of this and the fairly high level of light afforded by the 300-watt lamps the scheme failed, and when the original client sold the hotel the new owners took steps soon after to alter the scheme.

Showing a simple but effective lighting scheme designed to harmonise with the architectural features of the lounge.

The reasons for failure will, of course, be obvious to lighting engineers, but the case is quoted to underline the importance of balance between architectural effect and lighting principles, and to demonstrate the importance of the amount of light received by the structural surfaces—in a way, the success or otherwise of the design of the *room itself* as a lighting fitting. The large panels appeared very bright against the dark areas of ceiling, yet the confining effect of the deep rim threw the light mainly on the floor in pools which disappeared when the bar was full of people. What small amount of light fell on the walls was bounded by a hard curved line of shadow determined by the hard edge of the panel and scarcely relieved by the diffusing qualities of the glass.

When this problem was recently put before a meeting of the Illuminating Engineering Society, several members suggested various methods of relieving the hard effect—all in principle involved the introduction of light on the ceiling and wall surfaces. This is exactly what the new owners have done, by adding surface type ceiling and wall fittings they have lightened the dark surfaces, but unfortunately their choice and positioning of fittings is out of harmony with the ceiling shapes.

The lesson here seems to be that any scheme of ceiling panels will tend to look dark and heavy unless the panels are very near to the surface of the ceiling and some means is adopted to allow some light to penetrate along or be projected on the ceiling itself.

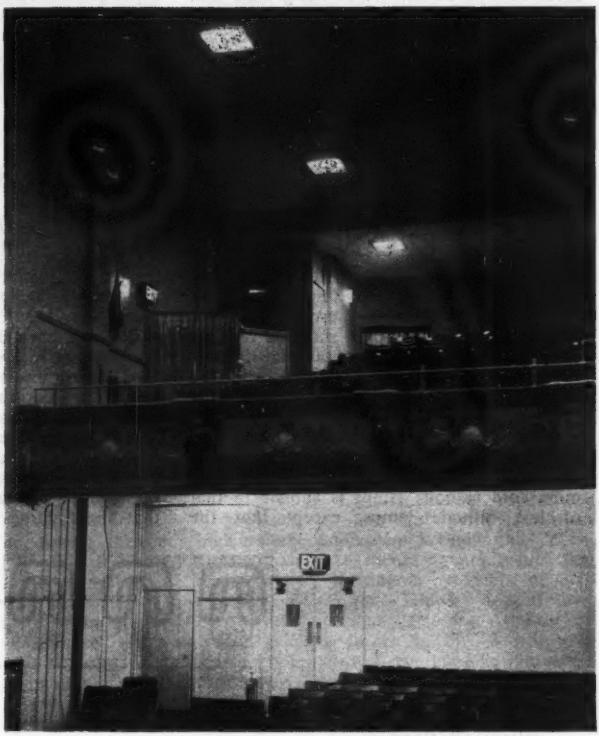
Curiously enough the scheme of small panels to the service bar was much more successful. This may have been due to the closer proximity of vertical surfaces to catch light—the bottles in the centre display fitting and the fitting itself—and the comparative shallowness of the rims round the panels due to the glass being nearer the ceiling. Finally the greater number of panels to a smaller area must have brought about a better relationship between lighted and shaded areas.

Quite a different and better lighting effect

(Continued on page 188)

Lighting in the Rugby Theatre

This small theatre is the home of the Rugby Theatre Society, an enthusiastic and progressive group of amateur actors who set themselves a very high standard in all matters pertaining to their art, including the lighting of the theatre. The following article describes the lighting which has recently been installed and describes the dimming system in some detail.



Auditorium lighting in the Rugby Theatre is the first of its kind in the country. This theatre has been converted from an old disused cinema entirely by the efforts of those interested in amateur theatricals in the district. The Borough Council and local firms assisted in various ways towards the success of the project and the B.T.H. Co.'s contribution of the stage, auditorium and general lighting, all installed by Messrs. W. J. Furse and Co., Ltd., of Nottingham, gives the Rugby Theatre Society what must be the best equipped theatre for its size and purpose in the country.

The auditorium lighting was specially designed by B.T.H. and consists of high voltage cold cathode tubes bent into a compact form to fit behind glass panels approximately 18 in. square in the false ceiling. There are ten of these ceiling fittings with two additional straight 8 ft. 6 in. cold cathode lamps mounted under the balcony. The lamps are supplied in two sets of six from transformers arranged in series connected to a common dimming circuit. This method gives improved dimming and also minimises the high voltage connections in the circuit.

Illumination in the theatre foyer and bar is provided by fittings each housing twin 40-watt 4 ft. fluorescent lamps. Exit lights and primary and secondary maintained lighting use tungsten filament lamps in neat and

(*Above*). Fig. 1. Showing general view of the auditorium.

attractive fittings. Outside the theatre two quarter-circle cold cathode tubes are mounted in the entrance arch to illuminate the steps and add brilliance to the exterior.

The stage lighting equipment was manufactured by Messrs. W. J. Furse and Co., Ltd., and provides a very comprehensive system for a theatre of this size. It comprises an eight-way spot bar, two three-colour battens, three-colour footlight, front of house spots and stage dips; a number of portable spots, floods and ground row strips for cyclorama lighting and curtain tracks are also supplied. Control of the stage installation is from a 30-way radial type dimmer board, each dimmer handle being fitted with a ratchet self-release gear. Master control of each colour shaft and ground master control of all colour shafts is provided. Contractor equipment giving independent colour and master black-out facilities is installed.

The Dimming System

By R. V. MILLS, Graduate I.E.E.,* and H. E. BELLCHAMBERS, A.M.I.E.E.*

The high efficiency of the fluorescent lamp, unlike that of the tungsten lamp, is maintained even at low currents, and for this reason the arc current must be reduced to a very low value to obtain satisfactory dimming. Fluorescent lamps can be dimmed to any specified level, and a circuit has long been developed (British Patent No. 551,487) which will enable hot cathode lamps to be dimmed down to 0.1 per cent. of their maximum light output. The problem of dimming cold cathode lamps is similar to that of hot cathode lamps, except that the cathode heating necessary for the latter at low currents is, of course, not required.

As the range of dimming required is extended, the size and cost of the auxiliary gear rises, and a new system, requiring the minimum amount of gear, has been installed in the recently opened Rugby theatre.

Illumination levels in each part of a theatre are planned in such a way that the patrons passing from the street to the box-office, into the foyer, and thence into the auditorium have their eyes easily adapted to the necessarily low level of illumination in the auditorium. High brightnesses and brightness contrasts in the auditorium should be avoided so as to assist easy adaptation to the stage lighting or screen brightness, and the decoration of the interior surfaces and furnishings are chosen bearing these factors in mind. It is also desirable that the lighting shall become an integral part of the architectural design, thus making possible an intimate and pleasant atmosphere. Fairly uniform illumination is required throughout the auditorium, and there should be sufficient light to see to pass down gangways and into seats with ease, safety and comfort, and to read programmes.

Dimming of the auditorium lighting is necessary to turn the attention of the audience towards the stage or screen without

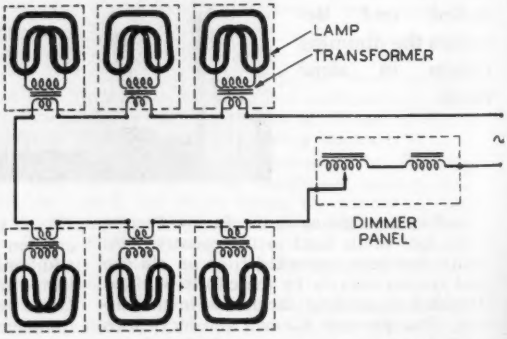


Fig. 2. Showing the circuit which includes six small high voltage transformers.

* Research Laboratory, British Thomson-Houston Co., Ltd.

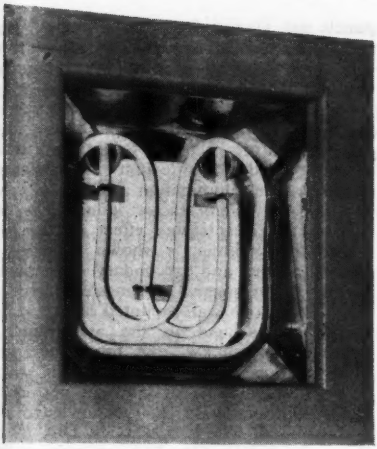


Fig. 3. Showing the special laylight unit with the glass panel removed.

visual shock. It has been found that dimming down to approximately 5 per cent. of the maximum light output is generally satisfactory for this application. The new dimming system gives stable operation and certain striking down to this value.

The circuit used in the Rugby theatre consists of six small high voltage transformers having their primaries connected in series as shown in Fig. 2. A single stabilising choke is connected in the series circuit together with a variable impedance, which is used to dim the cold cathode lamps used for general auditorium lighting. This system is equally efficient whether the lamps are in the bright or dim position, and no auxiliary D.C. supply is required for dimming. All dimming gear operates at mains voltage. For remote control the dimmer can be motorised and installed in any convenient position in the building, only two wires being required to connect it to a bank of six lamps. The primary circuit is substantially a constant current one, and should any lamp fail the remainder will continue to operate normally. In the bright position the dimmer is short-circuited, so that even if a fault occurs on the dimming equipment the lamps can still be operated at full brightness. The lighting unit may also be fitted with primary short-circuiting sockets and plugs, so that should maintenance be required on any fitting it can safely be withdrawn without having to switch off the remaining lamps. Under these conditions there will be five instead of six units in series, the circuit characteristics being such that the remaining lamps are not extinguished. Indicators can be fitted to inform the switchboard operator and stage manager whether the auditorium lights are in the dim or bright condition.

In planning the installation at the Rugby theatre, the above-mentioned desirable factors, i.e., graded lighting, avoidance of glare, uniformity of illumination, and smooth dimming have been taken into consideration. Lighting in the auditorium is provided by ten flush ceiling-mounted high voltage fluorescent laylight units, each approximately 18 inches square, while the under-balcony lighting is by means of two straight cold cathode lamps. Special laylight units (British Patent Application No. 23281/48), shown in Fig. 3 with the glass panel removed, are used in the auditorium. A 70-watt cold cathode fluorescent lamp 8 ft. 6 ins. long and 20 mms. diameter compacted into a grid formation is used as the light source; its electrodes are turned up at right angles for convenience of

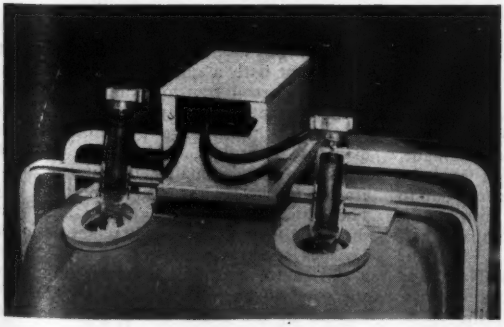


Fig. 4. Showing the transformer without the metal cover.

connections and as an aid to compactness. The lamp is housed inside an anodised aluminium reflector system of box construction. The small high voltage transformer behind the reflector is carried on two light angle brackets, and a light sheet metal cover protects the transformer and lamp electrodes, at the same time eliminating danger from contact with the high voltage circuit. This cover has been removed in the illustration Fig. 4 to show the small dimensions of the transformer and the short high voltage cables. In the design of the transformer special attention has been paid to the necessity for eliminating noise.

A panel of figured glass closes the reflector system, which has been specially designed so that at whatever angle the panel may be viewed it appears evenly flashed. The distribution of light intensity from the laylight unit is fairly directional, and the intensity at angles approaching the horizontal is small; therefore, when the panels are viewed from these angles, such as when seen from the balcony, their brightness is small as also is the contrast between the panels and the ceiling. The ratio of panel to ceiling brightness as viewed from the balcony is only 50:1, thus avoiding discomfort glare. Brightness ratios throughout the auditorium are nowhere excessive, the illumination is 3 lm./sq. ft., and the uniformity factor is nowhere less than 0.5. The pleasing effect of the new auditorium lighting is shown in Fig. 1. The primary and secondary maintained lighting is by means of tungsten lamps in small decorative wall-mounted fittings. The total lighting load in the auditorium is approximately 1 kw., the total floor area illuminated being about 2,560 sq. ft., which represents a loading of 0.4 watt per sq. ft.

The authors wish to acknowledge the permission of Mr. L. J. Davies, Director of Research, B.T.H. Co., Ltd., to publish this article.

Physical Society Exhibition

Description of the thirty-fourth exhibition of scientific instruments and apparatus held from March 31 to April 5, 1950, at the Royal College of Science, London.

Any description of the exhibition must begin with a warm tribute to those responsible for the organisation. This again showed a very marked improvement on the exhibitions of previous years, particularly on account of the longer period for which the exhibition was open, viz., five days instead of four. Although the exhibition was quite as popular as ever, there was a marked reduction of the congestion around the stands, and it was usually possible to see any particular item in reasonable comfort and to have a brief chat with a demonstrator to clear up any obscure points.

The number of exhibits of direct interest to the illuminating engineer was rather smaller than last year. In this respect the unfortunate use by chemists of the term "colorimeter" is worth mentioning. Two instruments, so described in the catalogue, proved to have nothing to do with what the physicist understands as colorimetry, but to be similar in object to other instruments more happily named "colour comparators." Some of these were primarily for the chemist, but the one shown by Nash and Thompson, Ltd., was designed for comparing the colours of slightly differing specimens of similar materials such as painted or enamelled surfaces. Each specimen was compared in turn with a magnesium carbonate standard, using a photovoltaic cell and a series of colour filters. No attempt was made to express the results on the C.I.E. system.

Another instrument for measuring reflection factors was shown by Evans Electroselenium, Ltd., who also exhibited their universal densitometer and an opacity meter for measuring the "covering power" of opaque films, papers, and the like.

Photo-electric spectrophotometers were to be seen on several stands. An elaborate instrument with a quartz prism suitable for making spectral transmission measurements, both in the visible spectrum and in the ultra-violet, was shown by Unicam Instruments (Cambridge), Ltd. This firm also showed a much smaller instrument with a grating for use in the visible spectrum only. The Hilger Division of Hilger and Watts showed a number of new attachments for the Uvispek spectrophotometer. These included a device for enabling the lines in a flame spectrum to be studied, using a glass prism instead of the usual quartz prism in order

to obtain greater dispersion in the visible region. Other devices shown were those for measuring diffuse reflectivity and for studying the fluorescence of liquids.

The Baldwin Instrument Company showed a number of photometric instruments. Their "photometer M.N." is an instrument in which an emission photocell is used in conjunction with a valve bridge as amplifier. It has a number of ranges, and on the most sensitive an illumination of less than 0.01 lm./ft.^{2} is readily detectable. For measuring transmission or reflection densities with the instrument special attachments are used. The transmission densitometer is shown with the photometer itself in Fig. 1. A microphotometer can be used to measure the densities of very fine lines on 35 mm. film.

Although there were several small photoelectric illumination photometers on view,

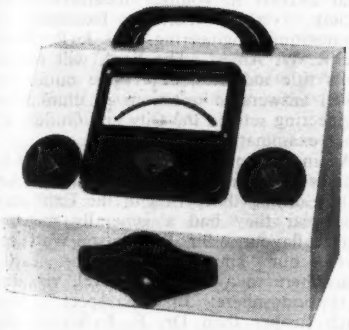


Fig. 1. The Baldwin Instrument Company's Photometer M.N.

there was only one visual photometer, viz., the Holophane Lumeter shown by Wray (Optical Works), Ltd. This instrument not only has a very attractive "new look," but is vastly improved in design as well, and conforms in every respect with the B.S. specification for visual portable photometers. It has a linear scale of illumination and another of brightness and has five ranges, so that illumination values from 0.01 to 8,000 lm./ft.^{2} can be measured. Colour filters, with appropriate correction factors, are provided for measuring illumination by mercury and sodium lamps. The general appearance of the instrument and its internal construction can be seen in Fig. 2.

On the stand of the Research Laboratory of the B.T.H. Company there was a demonstration of interest to the lighting engineer, viz., that in which was shown the cataphoresis which takes place in a fluorescent lamp operated on d.c. without reversal of polarity. Also on this stand was an interesting exhibit of some nine different types of lamps suitable for use as sources of radiation for laboratory work. A pocket spectroscope was provided so that the visitor could see for himself the type of spectrum provided by each source. Other laboratory lamps for spectroscopic purposes were shown by the thermal syndicate.

Siemens Research Laboratories showed a tungsten filament lamp in a quartz bulb for use as a radiation standard of known energy distribution in the near ultra-violet (0.3 to 0.4μ). By varying the temperature of the filament the spectral energy distribution could be varied in a known manner, and the use of quartz for the bulb had the additional advantage of making the lamp very small and compact. Another exhibit here was of a method for initiating an arc in a gas or vapour at high pressure (of the order of 1 to 5 atmos.) by the use of a short tungsten filament which, when brought to incandescence, caused instant starting of an arc between two tungsten electrodes.

The Research Laboratories of the G.E.C. showed the mercury isotope lamp, mentioned last year as providing a source of very pure monochromatic radiation for use as a standard of length, but the exhibits of direct photometric interest were on the stand of Salford Electrical Instruments, Ltd. The first was a general purpose illumination photometer, incorporating a "battery" of four photovoltaic cells in parallel, connected by a flexible lead to a microammeter. The others were a series of accessories for the S.E.I. exposure photometer. This instrument is, in essence, a visual photometer in which the luminous intensity of the comparison lamp is controlled by means of a photocell, and the instrument is normally used to measure the brightness of any portion of a scene. For use by the photographer in the field, the source of supply is a dry cell, but one of the accessories shown was an adaptor to enable the lamp to be run off a six-volt storage battery or a mains-operated transformer. Another accessory shown enabled the instrument to be used as a densitometer This attachment consisted of a tube with a lens, arranged to fit over the photometer telescope objective, so that an object placed at the end of the tube was seen in focus; the area thus observed was less than 0.01 inch in diameter so that the instrument became effectively a micro-

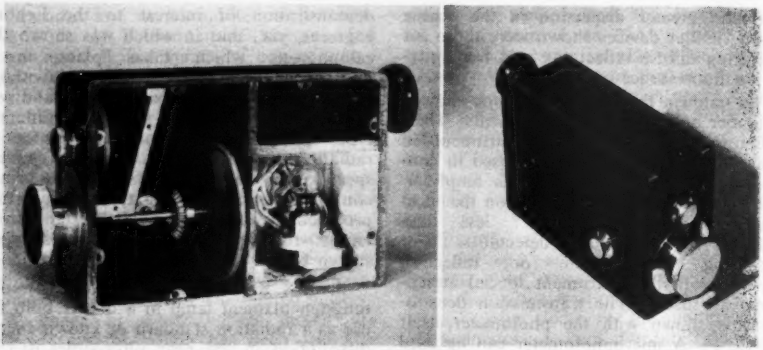


Fig. 2. The improved Holophane Lumeter.

densitometer. A special illuminator was provided for use when the instrument was being employed in this way. Another accessory was an "incident light disc" by means of which the instrument was converted to an illumination photometer. The "disc" consisted of a sandwich of diffusing glasses with a neutral filter, so designed that the brightness of the side facing the instrument, in foot-lamberts, was one-hundredth of the illumination of the front surface in lm./ft.^{2}.

Finally, mention must be made of a photometer for measuring very low values of illumination, shown by the Telecommunications Research Establishment of the Ministry of Supply. It consists of a "detector" containing an RCA 931A multiplier photocell and a lens system which limits the field of view as desired. The photocell is modulated at a suitable frequency by applying a push-pull drive on to two adjacent dynodes, and in this way the photo-current is cut off at twice the modulation frequency. The push-pull supply is adjusted so that induced second harmonic signals are balanced out. A narrow-band amplifier raises the signal to a suitable level, and it is shown on a linear meter. The voltage supply to the photocell is stabilised by a simple series valve, and the amplifier incorporates a negative feed-back. A standard screen of low brightness, made of a low-concentration radioactive luminous paint, is used to calibrate the photometer. The threshold is about 10^{-10} lumen.

As usual there were several stands on which the chief publishers of technical books displayed their latest publications in physics and engineering. In particular, MacDonald and Co. (Publishers), Ltd., were showing copies of a recent book, "The Principles of Scientific Research," by Mr. P. Freedman, a Fellow of the Illuminating Engineering Society. They also announced in the catalogue a book which should be of great interest to younger members of the Society, viz., "Worked Examples in Illuminating Engineering," by J. R. Harris and R. W. Ames. The book will consist, as its title indicates, of a large number of model answers to questions in illuminating engineering sets, in the City and Guilds, and other examinations.

As in previous years, a number of discourses were delivered in the large lecture theatre during the period of the Exhibition. This year they had a generally meteorological flavour. Sir R. Watson-Watt surveyed our knowledge of the earth's atmosphere to a very high level, viz., that of the ionosphere. In this respect he went much further than Dr. F. J. Scrase, who talked about the methods of sounding the upper air, and, in fact, he almost reached the realms described by Professor S. Chapman, the president of the Physical Society, whose subject was "Solar Physics and the Aurora Polaris." The discourse of most interest to the lighting engineer was, however, that by Dr. W. D. Wright, who talked about colour vision and colour television. He explained how any system of colour reproduction, whether it be colour photography, colour printing or colour television, depended fundamentally on the possibility of matching a large range of colours with three so-called "primaries" in suitable proportions. Various methods, he said, had been proposed for the production and synthesis of separate red, green and blue pictures, but in practice everything depended on the extent to which the new factor of colour in the television picture would make acceptable some sacrifice, both of brightness and definition.

Home Lighting

Lighting for Television

By E. R. HARRISON-JONES*

It would appear that opinions differ in the need or otherwise for lighting during the course of televiewing. With high screen brightness no modification to the room lighting is necessary. With the majority of television sets, however, lighting has to be dimmed or screened and the following article deals with the problem and suggests one possible solution.

Practically every invention one can call to mind produces a host of new problems, and television is certainly no exception. Quite apart from the technique of manufacture and transmission, there are the problems arising out of reception, which range from the wary approach of entertainment interests in the televising of events to the domestic question of how to get the children to do their homework when the rest of the family want to televiev. Sandwiched, as it were, between these problems is lighting for viewing television, considering the domestic case only.

In the early days before the war the problem did not consciously exist; the general case was to view in complete darkness. This was undoubtedly influenced by the average person's experience of cinema lighting, where the auditorium appears to be in complete darkness.

There are, however, certain differences between the conditions of viewing films and television. Firstly the cinema is, of course, by no means in complete darkness, for what is known as the maintained lighting enables the limits of the building to be appreciated. Thus the feeling of complete darkness, relieved only by the reflected light from the screen, is overcome, even though the light from these distant sources may be negligible at the seating point.

Secondly, the average brightness of a cinema screen, when showing, is about 5 ft. lamberts, whilst for a non-alluminised tube it is about 10 ft. lamberts, and for an alluminised tube it may easily be as high as 20 ft. lamberts. Although these figures vary considerably, depending on picture conditions, they illustrate well enough the brightness relationship.

Thirdly, the angle subtended by the two screens is different; for an average cinema the field of view extends vertically about 15 deg., whilst at a distance of 7 ft. from a television tube the angle is about 6 deg.

In short, the illumination at the average cinema seat may be no greater than that obtained when televiewing in a darkened room, but in the cinema one is viewing a lower brightness source sub-tending a larger angle to the eye with the room limits well defined.

Consideration of these points makes it apparent that, if undesirable contrasts—with consequent discomfort to the eyes—are to be avoided, a certain amount of background lighting, etc., must be provided. This fact is generally realised to-day, but in its interpretation the ordinary user has had to rely largely on his own resources.

However, it does not take long for the consistent viewer to appreciate points to avoid. One is that no direct light should fall on the screen, for this reduces the contrast. A considerable amount of research has been going on to minimise this trouble. and the use of special filters may be helpful, but as their use is not yet established the problem of direct light still exists. Where the light from the source is prevented from directly impinging on the screen, the general standard of lighting must, of course, be kept sufficiently low for the same contrast reasons. It is also desirable to avoid a reflection of the light source in the glass of the tube anywhere in the normal viewing range, for that particular spot would then become a dead viewing point.

Besides these negative precautions there

* Thorn Electrical Industries, Ltd.

are positive aims, such as the achievement of a standard of lighting which will permit reference to, for instance, the "Radio Times," without interfering with the picture clarity, and in the case of a group of viewers the ability to see clearly the features of one's companions.

A quite popular system is to place a floor or standard lamp in one corner, where the chimneybreast projects into the room, with the television receiver on the other side of the fireplace. This tends to illuminate about half of the room, but suffers from the disadvantage that part of the room in which the receiver stands is in comparative darkness; nor is it always practicable to have the light to the rear of the viewer.

Another method is to place a light behind the television receiver so that it is hidden from normal view. This has the advantage of defining the room limits within the normal viewing field, putting the receiver, and therefore the screen, in contrast and avoiding any direct light reaching the screen. The main disadvantage with this system is again the resulting low level of illumination in the viewers' part of the room.

It would seem, therefore, that an indirect light system making the ceiling a large area low brightness source would have definite advantages. The practical manner of achieving indirect lighting domestically deserves careful consideration, for this form of illumination is not generally associated with the average domestic living-room, which frequently relies on a simple central pendant for lighting. It is, however, into such homes that many television sets are being installed.

The requirements for comfortable television viewing are, briefly, the provision of about .25-1 ft. candles of general indirect illumination, together with an even distribution. It is also advantageous if the source can usefully contribute to the lighting of the room under normal conditions.

The central pendant fitting present in the average living-room must be excluded from consideration for television lighting because of its position and the nature of its light distribution. Direct type—as opposed to indirect—wall brackets are generally unsuitable, as they are distracting and would probably shed direct light on the tube face.

The aim, then, should be to provide an indirect lighting system which will give satisfactory standards of even illumination for televiewing and which, when not serving this purpose, will contribute to the general illumination of the room. The use of some form of dimming is, therefore, indicated.

Two simple ways of dimming an incandescent lamp are the series resistor, and, when two lamps are used, series operation. The main disadvantage with the latter is the necessity to use about 150-watt lamps to achieve reasonable values in series operation. Switching for series-parallel operation is also rather complicated, but this system may be applied under certain local conditions. As, however, the average domestic consumer seems to consider that anyone burning more than 150-watt of lighting in a living-room is either eccentric or directly interested in the manufacture of electric lamps, it is unlikely that this method would meet with much application.

The series resistor method is more satisfactory, for the extent of the dimming can be predetermined and lamps of a wattage suitable for normal conditions can be operated. Considering two 60-watt lamps in parallel, the resistor needs to be rated at about 17 watts to operate the lamps at about 160-v. on a 230-v. supply, and approximately 300 lumens are available. This is a normal dimming ratio of about 4:1, and in an

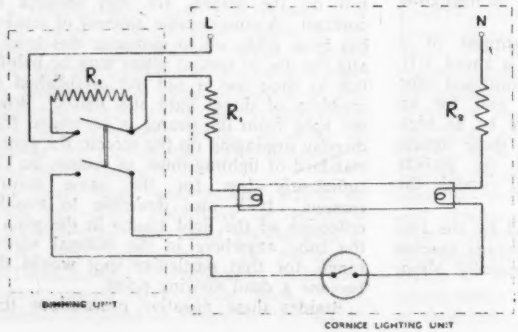
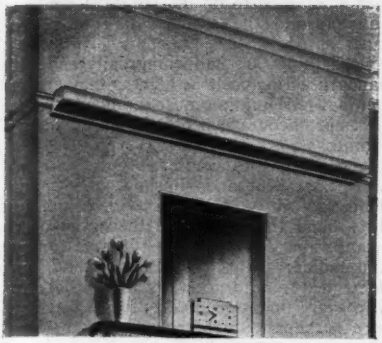


Fig. 1. Circuit for fluorescent fitting incorporating dimming system.



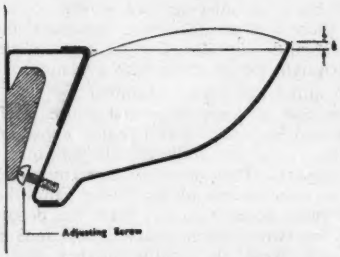


Fig. 2. *(Left)*. Example of fluorescent cornice fitting. Fig. 3. *(Above)*. Showing section diagram of fitting in Fig. 2.

average living-room gives about 1-ft. candle of evenly diffused illumination when dimmed. The resistor can be of reasonably small proportions and easily housed within the trough. The shorting switch can project from one end, or be completely within the trough and cord operated.

The advantage of a complete line source for an application of this nature is obvious, and a resistor controlled indirect domestic fitting employing a 4 ft. 40-watt fluorescent lamp can be used with satisfaction. Such a fitting can be dimmed, the circuit being shown in Fig. 1, and, with the exception of R.3 with its shorting switch, is identical to the production non-dimmed indirect domestic unit. This fitting gives a more even, and in this case a more suitable lighting system than the use of a pair of incandescent lamps within the trough and, considering total consumption, some appreciable running economy over the incandescent lamps.

When a television set incorporating a high brightness aluminised screen is considered, it may be possible to obtain a fairly reasonable contrast by using the 1,700 lumen source in an indirect trough, without recourse to dimming, but it may be found that the contrast and brightness controls must be adjusted for what would normally be considered extreme conditions.

Summing up, with an indirect system as just described, brightness ratios are reduced to at least acceptable proportions, room limits are defined, screen contrasts are only slightly affected, distraction from ceiling illumination is negligible, reflections in the screen are avoided, and good background lighting is provided for normal non-dimmed use.

"Cleanliness is . . . ."

The following is rather different from those articles on home lighting which have appeared in recent issues. It does not deal with the application of lighting in the home but it is addressed to those whose job it is to install lighting.

This is mainly directed to those who go into other people's houses and install lighting, electric lighting, for it does not apply to the gas industry, not because gas lighting is never installed to-day but because for some unpublicised and therefore unknown reason the gas industry installation engineers are clean.

One of the chief sales points in the early days of electric light was that it, too, was clean. No fumes, no blackened ceilings and so on; but, in the years between, what the light source itself has not done installation men seem to have made up their minds to do for it.

You may, of course, be sufficiently know-

ledgeable to do all your own wiring. If you are, then it is all the more necessary that you should consider for a moment the unfortunate lot of those who are not.

To quote two recent examples.

The first a newly decorated house, newly decorated because it was a rented house and the decorating was nothing to do with incoming tenants. They were as short of money as everyone seems to be to-day, and they were quite content to live with the decorations for two or three years. These tenants, however, were electrically minded, and if they were to use the light and other equipment they needed it was necessary that a considerable amount of additional wiring should be done.

Painstakingly they worked it all out with the contractor so that any new wiring would require the very minimum of disturbance to the decoration. The solution arrived at seemed sensible and simple, and the work was put in hand. Where conduit had to appear on the surface it was agreed that it should be painted in, as far as possible, with the walls.

The result? It was certainly a very sound electrical installation with nicely painted conduit, but such a crop of black finger-marks over everything within reach, and indeed at times in places which it must have required the utmost ingenuity to reach, that the entire house had to be decorated again.

Now this is true, and so is the next example.

This time an old house in a bad state of repair, a house needing decoration and where you would have thought nothing would have mattered. Again a thoroughly, irreproachably sound installation, but mess left behind which provided two people with almost a day's work to clear up and floor boards which had certainly been replaced but certainly not nailed down. These last were illuminating in their way, for, apart from the debris on the floors, it was, by raising them, possible to see the wealth of old material that had been swept under the floors. The back of one door, which only needed a single coat of paint to freshen it, had to be scraped down to the wood because a 150-watt lamp on the end of a wandering "flex" had been hitched over it the better to see a dark corner, and if you have ever let a 150-watt lamp rest against glossy paint for a working day you will know the result; if you haven't, you can imagine it.

Fiction, you will say. All right, a third instance. A newly decorated room with a number of flush switch plates which were difficult to replace. One of the contractors' men was asked to do it. He did it, but the walls around the switches had to be re-papered.

Such things are happening daily and with standard wiring costs as high as they are the fact that redecoration must be added to them does not encourage people to improve their lighting.

And there is no excuse.

It is careless and slipshod. Of course, hands get dirty during a wiring job, but dirty hands need not find their way on to clean walls and they must not. If every householder took a strong stand and demanded redecoration by the installation firm every time unnecessary havoc was done then perhaps it might be considered serious enough to stop. As it is the intimidated householder just shrugs his shoulders and says: "Oh, we've had the electricians in," as though the marks they left behind them were inevitable acts of God.

They are not, but they are inevitable until someone makes the effort to educate installation engineers in being clean. Light can be beautiful, but the means of conducting it to any particular point rarely are and they are not improved by the paw-marks of the animals that carried it there.

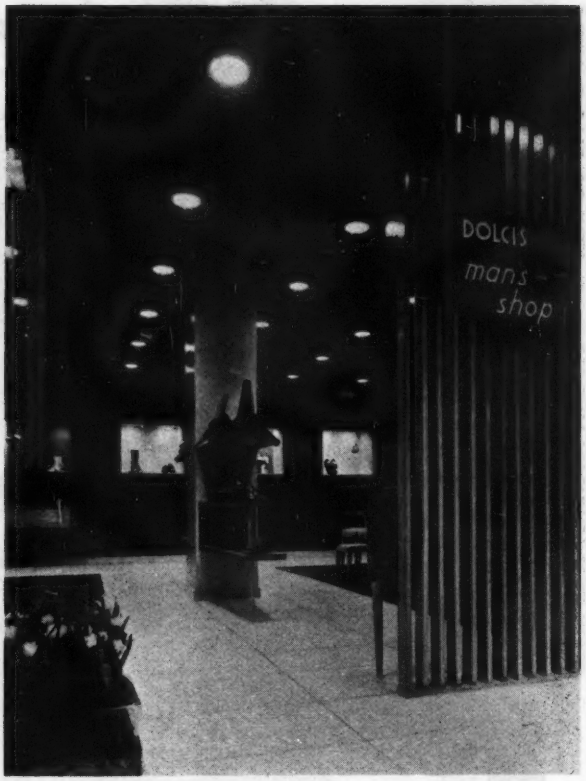
In a world where it is easier to be clean than ever before it should not be necessary to say any of this, but it is and it is high time that the industry as a whole woke up to the fact.

Cleanliness of another sort we might also mention, but not so harshly. Over a period of a few weeks lighting fittings in London and almost any large town can have their light output reduced by as much as a half through the collection of dust. Regular cleaning is essential. A soft brush for fabric shades, a soft rubber for parchment ones and warm soap and water for those that will take it, and for the lamps. It should be remembered that this applies particularly to fluorescent lamps and fittings for if, with the very long lives of the lamps, no cleaning is done between lamp replacements the remarkable light output is going to be reduced to a very sorry state indeed.

Museum Lighting

Museum lighting and the possible ill-effects of artificial lighting on museum pieces and paintings is one of the subjects now being studied, at the request of Unesco, by the International Council of Museums. These subjects were fully discussed at a recent conference in Stockholm, and a report on museum lighting by Sir Leigh Ashton, director of the Victoria and Albert Museum, will be discussed at the second conference of the Council in London in July.

Shoe Shop in Leicester Square



View of the men's shop from the entrance.

Reorganising their Dolcis Store in Leicester Square the proproprietors, Messrs. Upsons, Ltd., planned to make it unique but found it necessary first to tackle a problem far from unique to get their quart of planning into a pint pot of permitted expenditure and licences. That they succeeded reflects considerable credit on all concerned.

From the main doors an uninterrupted view of the entire ground floor is obtained and the lighting has been used not only to provide the correct illumination levels and brightness contrast necessary for modern store lighting, but to create an effective pattern designed to lead the onlooker into the shop and ultimately to the first floor.

The window lighting in general consists of recessed "Hyliter" Spotlights and specially designed recessed troffers complete with louvred panels for fluorescent lighting, and the rhythm of the design is continued uninterrupted into the shop. The main object of the fluorescent troffers in the window is to provide an effective brightness for the background in the windows, which have concealed backing, while the display lighting for the shoes is obtained from the recessed tungsten spotlights.

The general lighting in the ground floor interior is obtained from rows of recessed "Hyliter" Spotlights. These rows have been designed so that they follow the general interior design and assist in directing the attention to either the Man's Shop or the feminine section. The illumination level of this area is 20 lumens per square foot.

The main feature of the Man's Shop is the row of brightly lit showcases at the end, two concealed spotlights being used in each showcase. The main feature of the feminine section is the "Hit and Miss" display, illuminated by purpose-made tungsten troffers complete with louvred panels.

Provision has been made in these troffers for the use of coloured filters so that varying

General view of the first floor showroom.

Showing the louvred canopy over the counter on the left, and, on the right, spotlighted features.

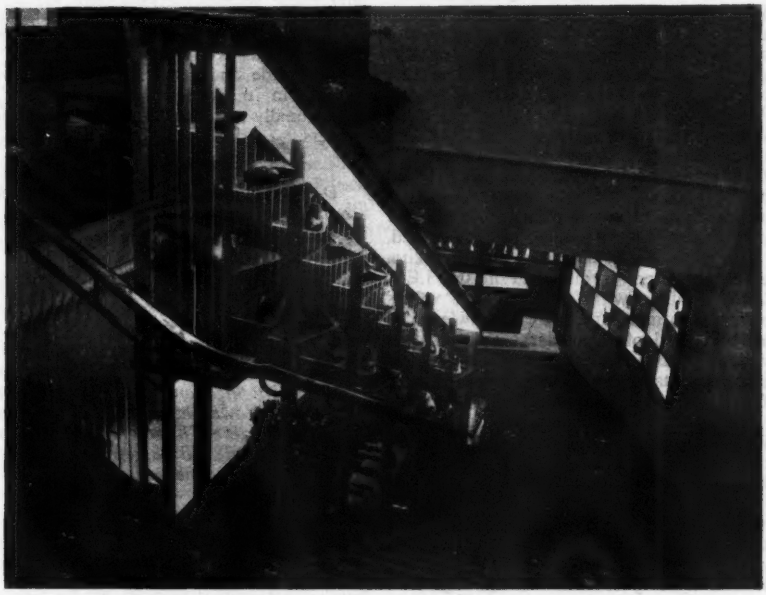
colour contrasts can always be obtained on this display. The general illumination in this section is obtained from a "free shape" coffer, using cold cathode fluorescent tubing, and giving an illumination of 30 lumens per square foot, which provides adequate brightness contrast for the display. In addition to the general illumination this lightens the ceiling and directs attention to the stairs.

The first floor lighting combines the intelligent use of varied types of light source, standard fluorescent, cold cathode, and internally silvered spotlights. The general illumination is obtained from specially designed cold cathode louvred fittings, suspended from the original ceiling to form a "free flow" design incorporating straight lengths and serpentine curves. The effect is that the original ceiling remains completely unnoticed in this modern West End store.

The central feature of the first floor, the handbag display, is illuminated by nineteen specially designed spotlight fittings recessed into a hanging canopy over the display. This provides an illumination of approximately 25 lumens per square foot, while the general illumination level in this area obtained from the cold cathode design is 20 lumens per square foot.

The sales counter on the first floor is given a high brightness level from the spotlights and fluorescent lamps incorporated in a louvred canopy above the counter, illumination at the counter top being 30 lumens per square foot.

Though the background lighting is hot or cold cathode fluorescent in the feminine part of the store, tungsten is used, and used heavily, to display the garments as it is the view of the architect of the store that women are accustomed to tungsten lighting and automatically make any necessary allowance for colour correction.



The staircase, showing the cold cathode lighting over the display.

Altogether, the Dolcis Store in Leicester Square shows refreshing originality and is a striking demonstration of the seeming brightness to which a store can be illuminated and yet remain within the permitted wattage loading. Full marks must be given to Dolcis, to their architect, Mr. Ellis E Somake, F.R.I.B.A., and to Courtney, Pope (Electrical), Ltd., who interpreted the architect's ideas and made and installed the equipment.

Problems in Illuminating Engineering For Students

By S. S. BEGGS. M.A., F.I.E.S.

9. *Interior Lighting Installations*

The basic principles of good lighting practice have already been covered in the Intermediate Grade studies; in the Final Grade the student is concerned with their application to practical installations.

When asked to design a lighting scheme, the lighting engineer has to answer two questions, viz.: (1) What is the lighting problem? and (2) What is the most suitable form of lighting to solve this problem? The first part is often termed "task analysis," and it is an essential part of the process if a satisfactory installation is to result; it will involve both general considerations and a study of the specific task involved. The second part depends on the first, and may also be considered under two headings, viz., quantity and character of the lighting to be provided.

The method of determining the quantity, i.e., illumination, is discussed in the I.E.S. Code, together with recommended values for many normal purposes. A knowledge of this basis and of the order of illumination needed for different categories of task is of more importance than detailed knowledge of the printed list of values.

The character of the lighting concerns the direction, degree of diffusion, brightness, contrast and colour of the light, and these are also discussed in the I.E.S. Code.

From a consideration of all these factors the nature of the lighting, the method to be adopted, form of equipment and possible type of light source will be determined. General lighting or localised lighting, or a combination of both, may be used. For the general lighting the position, number and rating of the units are determined by the well-known rules of the lumen-method of planning and practical considerations; for localised lighting the positional requirements and characteristics of individual fittings determine the arrangement to be adopted. Particular attention should be paid to the avoidance of glare.

The student should be well acquainted with the I.E.S. Code for the Lighting of Building Interiors. Every major field of interior lighting should be considered; besides industrial and general office lighting, such installations as library, school, shop and church require consideration; mines, railway stations and film studios are examples of important fields of application on which papers have been published recently. Although a detailed knowledge of recent developments would not be required, the Final Grade student is expected to know the trends in modern lighting; questions are occasionally set based on important recent papers.

Question 16 (1948)

Design the lighting for the following gauge room in a factory :—

Length, 60 *ft.* *Ceiling white*
Width, 30 *ft.* *Walls, light cream.*
Height, 12 *ft.* *No beams on ceiling.*

Benches, 4 ft. wide and 3 ft. high, run down the long sides.

Fine work, requiring 50 lumens per sq. ft., is done on these benches. A storage cupboard, 6 ft. high and 4 ft. wide, also runs lengthwise down the room; it is accessible from both sides. The room is to be temperature controlled and therefore has no windows, but is air-conditioned.

Answer

The "task" in this room involves measurements to a very high degree of accuracy, which implies the seeing of fine detail; the contrasts may not be great. A high level of local illumination is therefore required on the benches, and in this instance a value of 50 lm./sq. ft. is specified. The general level should not be less than 7 lm./sq. ft., and a value of 10 to 20 lm./sq. ft. is recommended, the higher value being adopted if fluorescent lighting is used.

Surfaces of metal gauges and tools are likely to have strongly preferential reflection characteristics, so, to avoid glare, low-brightness diffusing sources are desirable, especially for the local lighting units. The reflection of an *extended* area of low brightness in a polished instrument, such as a micro-

The first article in this series appeared in Vol. XI II, No. 9, September, 1949.

meter gauge, will help to reveal the engraved scale. However, for showing up fine markings directional light is preferable; the local lighting should therefore come from extended low-brightness sources, so placed as to make it directional in character. The general lighting can with advantage be fairly diffused, so that an adequate amount of light penetrates between the shelves of the cupboard, and heavy shadows therein are avoided.

The colour of the light is not critical, but a "cool" light is preferable to relieve the impression of stuffiness in a windowless room, and to suggest natural daylight.

The room is high and of light colouring, so full advantage of this height should be taken for the general lighting units; the localised lighting fittings must be of low external brightness and should be well clear of eye-level.

On the benches, surfaces of interest may have any inclination, so adequate horizontal and vertical illumination must be provided, although the former will probably be the more important. For the cupboard the light must enter at an angle and provide at least as good illumination on vertical as on horizontal surfaces.

Cleanliness is essential in a gauge room, so the fittings should be easy to clean and must not collect dust; smooth surfaces are desirable. Long life lamps reduce disturbance for lamp replacement.

The power dissipation in the lighting will eventually form a load on the air-conditioning system, for the latter is the main channel of extraction of heat from the room. Sources of high luminous efficiency are therefore specially desirable to keep the ventilation as well as the lighting load to a minimum. Radiant heat in particular is undesirable, as this tends to be concentrated with the light on to the work placed under high illumination.

A review of all these considerations suggests the use of tubular fluorescent lamps for both the general and localised lighting systems. High tension cold cathode lamps (of 10,000 hours' life) on a simple channel mounting would prove very suitable for the former, and hot cathode lamps (individually switched) in metal trough reflectors, with white diffusing interior surface, for the latter.

The coefficient of utilisation for the general lighting will be about 0.5, and as the room is air-conditioned a maintenance factor of 0.9 may be assumed. The triple tube H.T. unit of about 9 ft. length with a current of 120mA. dissipates about 250 watts and gives about 6,500 lumens average through life. The number of units, N, required to provide 20 lm./sq.ft. is therefore given by:—

$$N = \frac{60 \times 30 \times 20}{6500 \times 0.5 \times 0.9}$$
$$= 12 \text{ approx.}$$

These 12 units would suitably be mounted on the ceiling in two rows, each of six units on 10-ft. centres, above and transverse to the gangway between cupboard and bench; this provides good general diffused lighting for both bench and cupboard.

An 80-watt tubular fluorescent lamp in a diffusing reflector mounted four feet above the bench would provide on it an additional illumination of 30 to 35 lm./sq.ft. The reflector would preferably be of angle type, mounted above the front edge of the bench, and as many of these as required—up to a continuous row on 6-ft. centres—could be installed. These provide the desired high level of directional lighting for the discrimination of detail in average material; they would also illuminate the wall to a brightness of about 20 e.f.c., of which the reflection in polished surfaces could be used to reveal clearly gauge markings, flaws, or damage to the surfaces.

Question 17 (1942)

Design a system of concealed unidirectional artifical lighting for the nave and chancel of a church, 100 ft x 30 ft.; roof height 30 ft. State the advantages of the system.

Estimate a coefficient of utilisation and reflector efficiency, and so choose the light output required from each light source. Show the run of the wiring and the location of any switches or control gear that you would recommend.

Answer

The main advantage of this system of lighting for a church is that the beauty of the structure can be revealed, enhancing the atmosphere of the place, without attention being distracted by the source of the light. It is the nearest approach to natural daylighting, especially where there are clerestory windows. There is no danger of glare, and by suitable disposition of the units a soft, but not featureless, light is provided, giving adequate illumination at pew level for reading small print (common in hymn and prayer books) with sufficient illumination of the walls and ceiling to show their architectural features and decorations to advantage. However, it cannot be

applied to all churches; it will be assumed that the example to be considered in the question is suitable to such treatment.

The "task" in a church is to take part in the service, which demands a comfortable and clear view of the altar, chancel, pulpit and lectern, and the reading of hymn and prayer books. A general illumination of 5 lm./sq. ft. should be sufficient in the body of the church, with an increase of about 50 per cent. in the sanctuary and chancel to accent these areas. Positioning of the lights is most important, and is adequately covered in the concealed system provided full advantage is taken of the height of the building. Tungsten filament lamps are probably most suitable, on account of the light control possible and the ease of concealment of a small unit.

Silvered or prismatic glass reflectors are desirable, which, in a good design, direct about 40 per cent. of the lamp light into the main beam (of about 40 deg. spread), and have a total light output ratio of not less than 70 per cent. A coefficient of utilisation of about 0.4 may be assumed, and a maintenance factor of 0.8 should be sufficient. To provide an average illumination of 5 lm./sq. ft., the total light output of the sources required is given by:—

$$F = \frac{100 \times 30 \times 5}{0.4 \times 0.8} = 47{,}000 \text{ lumens.}$$

There will probably be columns, arches or other architectural features which divide the nave into sections; it will be assumed that there are transverse arches at 15 ft. intervals. If a unit be mounted on each side of the nave and chancel behind each arch, there will be 12 lamps, and each must be of about 4,000 lumens output. (A 300-watt g.l.s. lamp would be suitable.) The augmented intensity in the chancel and sanctuary can be obtained by an additional central unit at the head of each of the nearest two arches, or, if more convenient for servicing, by replacing the normal lamps by the next higher rating (500 watts).

The units should be mounted as high as possible with accessibility for maintenance. and not less than 15 ft. above floor level. Those in the nave should be directed across the nave and forward at about 45 deg., so that the beams cross, but those in the chancel should be directed more steeply downwards because of the choir. A sufficiency of upward light must be available to avoid a dark ceiling.

The wiring should be arranged so that the lamps associated with each arch are controlled by one switch, and the switches for the body of the church should be located in an oak box near the entrance. Switches for the lights in the chancel should be placed by the vestry door. Dimming is not recommended, but if insisted upon each single 4,000-lumen source in the nave could be replaced by two smaller units (e.g., a 200-watt and a 100-watt lamp) so that the general level may be reduced when the full intensity is not required. The wiring should be as inconspicuous as possible and can be concealed by moulding and architectural decorations. It will normally run at corbel-table level, and may be carried over the arches. Conduit is favoured for safety, but lead-covered or tough-rubber cable is sometimes acceptable, and is less obvious where concealing features are lacking. (Lead covered cable, however, should not be attached to oak, on account of a chemical action between them.)

Harmony of Lighting and Architecture

(Continued from p. 172)

was afforded by the scheme for the lounge, and this has survived both owners. As a lighting scheme it is nothing out of the ordinary, but is illustrated as an example of a simple, inexpensive and yet effective way of combining standard ceiling fittings with simple architectural elements in order to enhance the importance of the fittings and to bring them into the general architectural effect both by day and night.

This room was formed by removing the partition walls between three small rooms, as a result of which a rather long and narrow shape emerged. It will be noticed that this was counteracted on the walls by the introduction of broad pilasters, while the ceiling is divided into three main square panels by means of planted strips which join with shaped wood panels on which are mounted two standard ceiling type opal glass fittings.

The device is not new, of course; more or less elaborate paterae have been used in connection with lighting fittings for years. but the combination of two fittings in a shape with a direction chosen to balance the main and rather disturbing lines, together with the linking of the whole in a general architectural composition, demonstrates the degree to which a lighting scheme may contribute to a pleasing decorative effect in harmony with the architectural forms and surfaces.

Correspondence

Lighting Units

Sir,—If I did not know the identity of "Dimwit" and if I could not make a shrewd guess at the identity of the individual who skulks behind the wholly inaccurate pseudonym "Dimmerwit," I should still commend their anonymity on grounds of expediency.

Neither the reactionary foot-candle nor the progressive lura inspire any crusading urge and I have no doubt that when either of these gentlemen has something of significance to contribute towards lighting nomenclature he will discard the furtive cloak and prepare to receive the plaudits of the pundits. Pending this event I humbly submit that the true solution to the nomenclature problem has been staring at us from the very beginning. We must adopt the Lux. If there are objections to the metric system, and there always are, I would point out that there just isn't a better word for the job and we might as well get used to it.

In proof of my confidence in this solution I sign myself, dear sir, Yours, etc.,

"HALFWIT."

London.

LIGHTING UNITS

(with apologies to Dim and Dimmerwit)

Little lots of Lumens
As little lots of light,
Worry pseudonym "Dimwit"
Into shocking frights.

"Dimmerwit" won't wear it,
He stands in mighty scorn
Of them what calls 'em Candles
Which phrasing's reckoned worn.

Now which of us can help them
Which one will it be,
Lumen lurking "lura"
Or Foot and Candle free.

"DIMMESTWIT."

Watford.

Theatre Lighting by Fluorescent Lamps

Sir,—We are interested in the report of "I.E.S. Activities" (London) in the March issue, and in particular Dr. J. W. Strange's remark that ". . . they (fluorescent discharge lamps) have not previously been used for this purpose," i.e., stage illumination.

Whilst we agree fully with Dr. Strange that the recently developed range of these light sources require a method of light control to make them effective for stage craft we think that he, and possibly your other readers, may be interested to know that we claim to be the first electrical contractors and illuminating engineers to use fluorescent lighting for a professional theatre *nearly three years ago*! The equipment then installed is still carrying out its intended functions and operating satisfactorily.

Our installation mentioned above is at the Miner's Welfare Hall, Glynneath, and we changed over the entire lighting of these premises, including auditorium, foyer, stairways, passages, library, reading room, committee-room, and billiard-tables lighting, to fluorescent. On the stage, however, we made no attempt to replace the normal dimmer-controlled lighting battens and foots by fluorescent, but we made up two supplementary battens, one of three standard 5-ft. 80-watt trough-type fittings, and a parallel batten of two such units and these are "flown" above the stage. The main purpose of the fluorescent lighting on the stage is to economise in current consumption when the stage is used for addressing meetings, etc., since the previously used consumption for this purpose, with filament lamps, was at least 4 kw. and often a higher loading was wastefully employed; it has been found, however, by producers of stage shows at this theatre that the daylight fluorescent lighting often blends very well with, and adds brilliance to, the standard stage illumination, in particular for "outdoor" scenes. It tends to counteract the rather yellow lighting from the filament lamps and this, we think, is a common fault in smaller theatres where the degree of light output from elaborate installations is not available and when "spotting" has to be done not by arc-lights but by projectors using high output filament lamps which lose a considerable amount of their upper spectrum output from the condensers employed. The coldness of a number of daylight fluorescent lamps is thus of considerable help and could be much more widely used even without dimming equipment suitable to their characteristics.—Yours, etc.,

P. A. DUNCAN.

Electrical and Associated Services (Mumbles), Ltd.

New Lighting Installations

Fluorescent Lighting for Station Platforms

In the autumn of 1949, when the electrified Liverpool Street to Shenfield section of the Eastern Region, British Railways, was brought into use, fluorescent lighting fittings displaying the station name were installed for the illumination of the covered part of the station platforms. This type of lighting is now being extended to the open part of the platforms by means of lanterns (each containing two 5-ft. 80-watt fluorescent lamps) specially designed to the requirements of the Electrical Engineer, Eastern Region, by The General Electric Co., Ltd. A total of 179 lanterns are being erected at nine stations.

Each lantern is mounted on a reinforced concrete column, octagonal in section, with a compartment in the base to accommodate the usual control gear for the two lamp circuits. The mounting height to the centre of the lanterns is 12 ft. 6 in. and the columns are spaced 40 ft. apart.

On the single platforms the lanterns are mounted parallel with the track, and those on the island platforms are at right-angles to it. The light distribution is such that both methods of mounting provide very even illumination, averaging about 1 lumen per sq. ft. over the whole platform area. By arranging the lanterns on the island platforms at right-angles to the direction of travel of the trains, it is made easier to passengers to read the station names on the lanterns as they pass.

Special attention has been given in the lantern design to easy maintenance arrangements and resistance to the effects of weather and soot or grit in the atmosphere. The lamps, arranged one above the other, are totally enclosed by an opalescent plastic trough of low light absorption, with the station name appearing in dark blue colour on both faces.

The lamps, gear and columns were supplied by the G.E.C., Ltd.

Lighting a London Restaurant

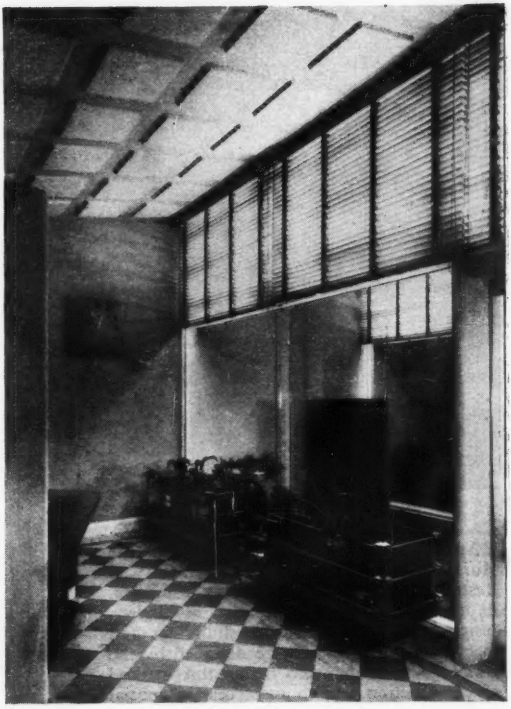
The interesting installation illustrated on page 166 was carried out by Messrs. Courtney, Pope (Electrical), Ltd. The louvrall ceiling is constructed in sections, and the cells of the louvre are 3 in. by 3 in. Continuous lines of cold cathode fluorescent tubes are installed above the louvres at approximately 2-ft. centres. The level of illumination obtained is 12 lumens per sq. ft.

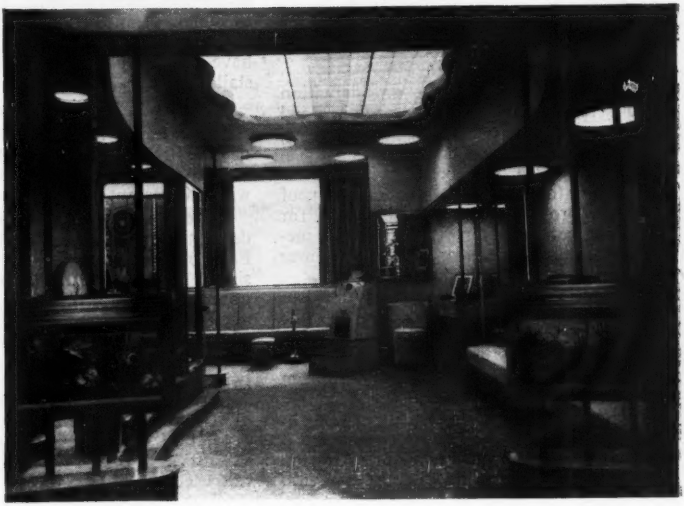
(Left) Showing arrangement of lanterns at right angles to track on island platform at Seven Kings station.

Two Unusual Installations

The picture on the right shows the reception-hall of the new showrooms recently opened by Pilkington Bros. Ltd. at their London headquarters, Selwyn House. The object of this showroom is, of course, to show the products of this company, and the hall is an attractive example of the combination of plate glass with fluorescent lighting. Daylight tubes are installed between twin sets of Venetian blinds the laths of which are painted white.

The picture at the foot of the page shows a shoe department designed exclusively for children which has been opened at the premises of Peter Yapp, Knightsbridge. The department has been divided in three sections for age groups under five, under 10, and under 12. In the first two sections the lighting is from aluminium egg-crate type lighting units suspended from the ceilings with spotlights over the seats. In the under-12 section the lighting is from two rows of "porthole" ceiling lights. The architects were Donald Hamilton, Wakeford and Partners.





(*Above*) The reception hall at Selwyn House. (*Right*) Showing the unusual lighting treatment in a London shoe shop.

(Left) Showing an installation of 300-watt lamps in reflector bowl fittings at the new factory of the Morgan Crucible Company.

Factory Lighting

An interesting lighting installation at the Morgan Crucible Company's new factory at Neston is shown in the above photograph. A pre-cast concrete construction of modern design has been used for the buildings and special lighting fittings were designed by the Holophane Company to match this method of construction and to meet certain special requirements of the working processes. It was desired to mount the fittings direct on the sloping concrete purlins and to avoid any possibility of dust collecting on the fittings or on the supply wiring.

The fittings themselves are an adaptation of the recently developed Reflector-Bowl Pendants, a feature of which is a rubber gasket which makes them dust-tight and moisture-proof. They have been made with inclined tops to match the rake of the roof and with provision for several entries for Pyrotenax conductors, so that separate junction boxes are unnecessary and the labour of fixing considerably reduced.

The factory will be engaged on the production of high-grade refractories, and the maximum elmination of dust is essential. Great care is being given to the ventilation and air circulation, and the fittings have been designed with smooth vertical surfaces, free from any projections on which dust might accumulate.

The lighting scheme was planned by the Holophane Company in collaboration with the Chief Electrical Engineer of the Morgan Crucible Company, to provide an average service illumination of 12 lumens per square foot. This result has been achieved by using 300-watt lamps in the reflector-bowl fittings, which give a particularly efficient downward projection of the light through the translucent glass sides to illuminate the roof and to give a lively, well-lit appearance to the factory. No maintenance is required between re-lamping and the fittings may be expected to remain clean for long periods.

The Phoenix Electrical Co. (London), Ltd., have been responsible for the electrical installation.

Office Lighting

The entrance hall and ground floor office of the Hearts of Oak Benefit Society, Euston-road, London, has just been relighted with fluorescent lamps.

Novel use is made of the three existing decorative-style lanterns in the entrance hall. Each of these is adapted to accommodate a single 18-in. 15-watt fluorescent lamp with its control gear. Lighting in this area is augmented by the use of three ceiling mounted fittings, one of which houses a single 80-watt 5-ft. lamp, and the other two, twin 40-watt 4-ft. lamps.

In the main office general lighting of 15/16 lumens per sq. ft. at desk level results from a total of 41 fluorescent fittings with 5-ft. 80-watt lamps. B.T.H. lighting equipment was used.

LIGHTING FITTINGS

Following an article on the lighting of flowers which appeared in a recent issue, it is interesting to note that ROWLANDS ELECTRICAL ACCESSORIES, LTD., have just introduced a special plinth light for lighting vases or bowls of flowers. The fitting is illustrated on this page. It is mounted on rubber feet to prevent damage to furniture, and the

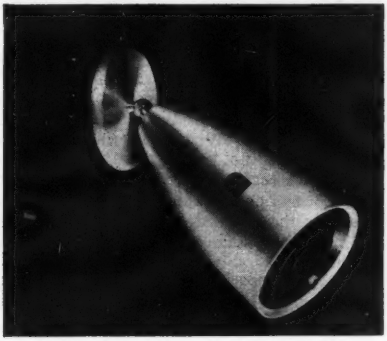
The R.E.A.L. plinth light.

glass plate is strong enough to carry the heaviest vase or bowl. It is supplied in a variety of colours. It is stated that a 15-watt lamp only need be used to give very satisfactory results. The price is 30s., inclusive of tax. A smaller model is available, price 24s. 9d.

The "Weymouth" spotlight reflector, just announced by PHILIPS ELECTRICAL, LTD., is designed for local lighting, using a 150-watt tungsten lamp or, alternatively, the 160-watt blended lamp, or 150-watt tungsten reflector spotlamp. Fitted with a universal joint for 2-in. conduit box fitting, the exterior finish is of brushed aluminium with black anodised detachable louvre. List price 56s. 6d.

The same fitting can be supplied at no extra cost with a 6-in. diameter weighted baseplate so that the fitting can stand on the floor of shop windows, etc.

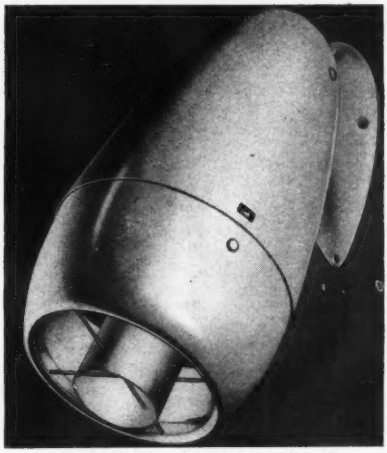
CROMPTON PARKINSON, LTD., also announce the introduction of a new "Comet" reflector spotlight fitting designed to give emphasis or high-lighting for displays in shops and



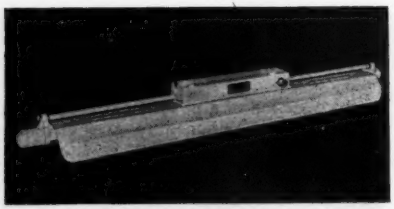
Philips' 'Wey mouth' spotlight

shop windows. Typical applications are stated to be: to produce attractive effects on show counters for jewellery or glass and to introduce high contrast of architectural features. The list price is 34s. 6d.

To enable the advantages of fluorescent lighting to be obtained in industries where the atmosphere is either dust- or vapour-



Crompton's 'Comet' spotlight.



Crompton fluorescent fitting for use in dust-laden atmospheres.

laden, CROMPTON PARKINSON, LTD., have introduced two new types of fluorescent lighting fittings. With these fittings all the parts that would be affected by dust or vapour are sealed off from the atmosphere. Both fittings are of the similar basic design shown in the illustration, but differ in detail and method of sealing according to working conditions.

Tough light alloy is used throughout for the enclosure of the high power-factor control unit, lamp-ends, and lampholders. The control unit is mounted centrally on top of the reflector, and the wiring is taken to each lampholder through heavy-gauge tubes, which are sealed off at each junction. The reflector is an open-ended pattern secured to the central unit by two finger-operated positive fixings.

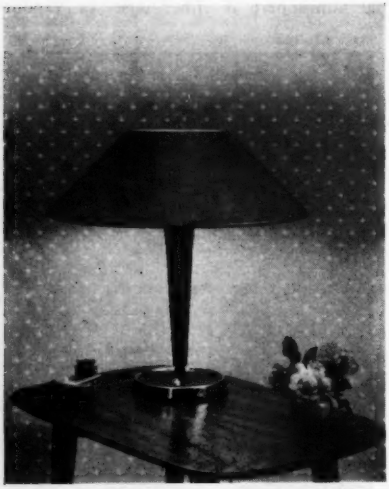
The fitting is arranged for either chain or conduit suspension. With conduit the conductors can be taken directly to the gear housing, and with chains the connection is made through the water-tight sealing gland fitted to the side of the gear housing. The fittings are designed so that there are no wells or channels to hold moisture, and the use of gaskets and glands prevents moisture from reaching the control gear, lamp-ends and lampholders.

The dustproof fitting (AF. 1111) is for use in textile mills, for colliery applications both at the surface or in safe underground areas, cement mills, tile-making works, flour mills and other places where the atmosphere contains dust or fluff. In this fitting sealing is effected by felt gaskets.

The vapour-proof fitting (AV. 1112) has special silicone plastic washers sealing the lamp-ends to allow the fitting to be used in moist or wet atmospheres. It is particularly suitable for farm buildings, laundries, dye-houses, etc., and for those industrial areas where moderate concentrations of acid or alkaline vapour may be present.

Although the fittings are effectively sealed, the lamps are easily replaced by the removal of end covers, each secured by a single captive finger-nut. The starter switch is inserted in a gasketed hole in the side of the control gear box.

Compared with fittings having a glazing frame and gasket, these new types not only reduce the work of installation and maintenance, but also have a much better light output.



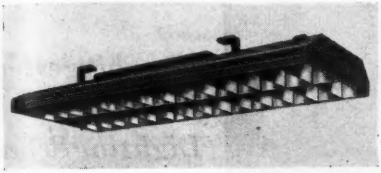
Merchant Adventurers' table lamp.

An attractive home lighting fitting is the desk lamp known as "Decorlume" Unit MA6121 made by MERCHANT ADVENTURERS LTD. This lamp is fitted with an internal glass bowl on which the shade rests, giving both direct and indirect lighting. The shade is of spun anodised or colour sprayed aluminium. The stem is of teak and the metal base is weighted and has a wood veneered insert. The unit is designed for use with a 150w. lamp and sells at £7 15s., plus £1 18s. 9d. purchase tax.

Two new decorative twin-lamp fluorescent fittings with louvres have been introduced by THE GENERAL ELECTRIC CO., LTD., the first of a range of five basic designs. Both fittings are similar in design, but one is a shallow pendant while the other has a top flare for ceiling mounting. Each is available for 5 ft. or 4 ft. lamps. The body of the fitting is of rustproof sheet steel, with a general finish of ivory stove enamel and bronze colour ends. Side panels of luminating glass impart a light and pleasing appearance. The louvre frames are hinged to permit access to the gear channels from below, but the lamps can be lifted out of the tops of

the fittings without disturbing the louvres. The end covers are integral with the body and shaped so that the fittings can be butted together for continuous lighting.

EKCO-ENSIGN ELECTRIC, LTD., announce single and twin-lamp shop-window lighting



Ekco-Ensign twin lamp shop window lighting fitting.

reflector fittings for use with 40-watt 4-ft. fluorescent lamps. These fittings—Cat. No. FF4/111 (single lamp) and Cat. No. FF4/211 (twin-lamp)—are designed primarily to light shop-windows and large showcases effectively with 40-watt 4-ft. fluorescent lamps. They are also suitable for floodlighting display areas and backgrounds, either mounted above the display to project the light downwards or, at the base of the display, to project the light upwards. They can also be installed in picture and art galleries, or in any location where lighting on a vertical surface from a concealed source is required.

Trade Literature

THE BRITISH THOMSON-HOUSTON CO., LTD. "Mazda" lamp catalogue listing all "Mazda" lamps available from January 1, 1950 with full details. Includes section on equipment and general information.

EKCO-ENSIGN ELECTRIC, LTD. Price list of all Ekco fluorescent lamps and equipment.

THE EDISON SWAN ELECTRIC CO., LTD. Leaflet on Ediswan enamelled iron signs.

THE MERCHANT ADVENTURERS, LTD. 1950 catalogue illustrating complete range of "Utilume," "Decorlume" and "Fluorelume" tungsten and fluorescent lighting fittings.

METROPOLITAN-VICKERS ELECTRICAL, CO., LTD. Illustrated catalogue of Metrovick street lighting fittings including lamps, gear, columns, etc. Also illustrated catalogue of industrial fittings for mercury discharge and tungsten filament lamps, and illustrated price list of fluorescent fittings.

SITUATIONS VACANT

MINISTRY OF TRANSPORT

There are vacancies in London for ASSISTANT ENGINEERS (Electrical and Mechanical) with suitable experience. Candidates should be Corporate Members of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, or hold a University Engineering degree or other examination passes exempting them from Sections A and B of the examinations for Associate Membership. The work of electrical engineers is concerned with street-lighting schemes and development, with the design, performance, and use of traffic-control equipment and traffic signs and with the study of road-traffic problems; that of mechanical engineers concerns matters relating to design, construction and development of road vehicles. Salary scale £475 × 25 — £750 per annum; starting pay will be assessed according to age. The appointments will be on a temporary basis, but there will be opportunities of securing establishment for candidates up to the age of 35 or possibly to a later age. Apply in writing, giving full details of qualifications and experience, to the Principal Establishment Officer, Ministry of Transport, Berkeley-square House, W.1.

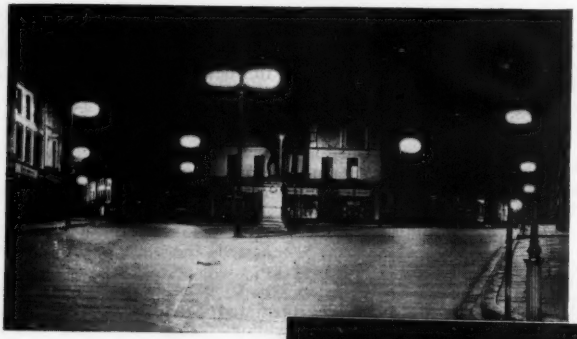
LIGHTING SALES ENGINEER required for West Country and South Wales by large electrical manufacturers. E.L.M.A. members. Must have an electrical background, preferably Nat. Cert. Lighting experience preferred. Car driver essential. Write, giving full particulars of age, previous experience, and salary required to Box 806.

TWO SALES ENGINEERS for London and Nottingham Areas required by E.L.M.A. manufacturers of lamps and lighting equipment. Electrical training and experience. Nat. Cert. E.E. preferred. Lighting knowledge an advantage. Car provided. Must have urge to sell. Remuneration according to qualifications. Write, giving full particulars of age, experience, and salary required, to Box 807.

DESIGNER, Senior, required to take charge of drawing office, North Birmingham area. Sound experience in design of industrial and commercial lighting fittings essential. Knowledge of photometry and experience in carrying out lighting tests an advantage. Excellent prospects for man with ability. State experience and salary expected. Box 808.

LIGHTING ENGINEER. Assistant Technical Engineer required in Lighting Laboratory of leading E.L.F.A. Company. C. and G. Certificate (Inter.) in Illuminating Engineering, and National Certificate in Electrical Engineering essential. Good prospects and pension scheme. Location—Enfield area. State full details of qualifications and experience, age and salary required, to Box No. 224, c.o. Dorland Advg., 18, Regent-street, London, S.W.1.

The LISBURN STORY . . . .



The biggest fluorescent Lighting Scheme in Northern Ireland

NEW STREET LIGHTING WITH

SIEMENS

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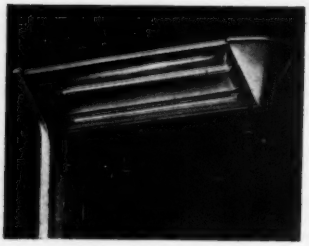
FLUORESCENT LAMPS AND LIGHTING EQUIPMENT



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I.E.S. ACTIVITIES

London

A paper entitled "Visual Aids for Landing in Bad Visibility" was presented at the London sessional meeting on April 11 by Mr. E. S. Calvert, of the Royal Aircraft Establishment, Farnborough.

The paper dealt with the development of high intensity aids, that is, the aids which in bad visibility enable the pilot to bridge the gap between the runway and the point on the approach path where he can no longer follow the electronic approach aids. For the two electronic aids in general use at present, i.e. the Instrument Landing System with manual coupling, and Ground Controlled Approach, this is from about 200 ft. downwards. This last 200 ft. is the most critical part of any bad weather landing for the reason that it involves a quick transition from instrument to visual flight in conditions in which the horizon and other indications which the pilot instinctively uses to make his judgment are blotted out.

To people accustomed to driving a surface vehicle it may seem that some simple pattern such as a line of small-sized lights along the left side of the approach area will give the pilot all the guidance he needs. This and similar patterns have been tested in many different countries, and it has invariably been found that they did not provide the necessary guidance in visibilities worse than half a mile. In fact, some of them were as much a hazard as an aid in that they were liable to produce illusions and misjudgments at the moment of transition. The main reason for this is that an aircraft has six degrees of freedom, as against only three for a surface vehicle. These three extra degrees confuse the indications given by the lights, i.e. changes in bank confuse the indication of lateral error, changes in pitch confuse the indication of aiming point, and changes in heading confuse the indication of direction. It is necessary for safety that any pattern used as a visual aid must contain sufficient indications to make the aircraft's position, altitude and direction of motion geometrically determinate, and must give these indications in a form which the pilot can assimilate instantly and instinctively in moments of mental stress.

This paper discussed these illusions, and showed that they are due to two deficiences in the patterns used, i.e. absence of texture, and absence of a horizon indication. The first can be eliminated by using fittings of appreciable size, thereby giving an appearance of reality to the pattern, usually known as "depth." The second deficiency can be eliminated by using bars of lights running transversely across the approach area. This is the basis of the Crossbar System, which consists of a line of lights along the middle of the approach area, with bars of lights running transversely across it at intervals. Eleven installations of this system were put down on the Air Lift, and another has been in use at London Airport since November, 1948. Landings with passengers have been made on the London installation in daytime in meteorological visibilities down to 250 yds., and pilots have reported that they are able to use the system with confidence and safety even at the first attempt. (The limit for civil operations at night is somewhat lower than this, probably of the order of 150 yds.) The system has been found to be particularly effective in those cases in which the depth of the fog layer is less than 100 ft. This is quite a common condition at inland airports in this country.

International standardisation is necessary if visual aids are to be used with maximum efficiency, but this is difficult to achieve because it involves questions both of economics and prestige. In this case the difficulties are increased because there is no generally accepted theory as to how visual judgments are made. An attempt has, therefore, been made to build up a coherent theory of visual judgment, and to use this to evaluate the guidance which is provided by three systems which have received most support, i.e. the Crossbar System, the Slope-line System, and the single line on the left. This theory, which is known as the "parafoveal streamer" theory is briefly as follows: When the aircraft is several miles from the runway, the angular subtense of the pattern and the rate of change of perspective image are both small, and the pilot makes his judgments by scanning the pattern and comparing the perspective image with an ideal one which he carries in his memory. As the aircraft comes closer to the pattern its apparent size becomes so large that the pilot can no longer scan it comfortably. At the same time the rate of change of the perspective image rapidly increases. At about 150 ft. the pilot begins to stare straight ahead with his head and eyeballs fixed. After this he derives his impressions of height and direction of motion mainly from the pattern formed by the paths which the retinal images

of the lights trace out on the parafovea, and from the velocity of the images along these paths. These paths may be called "streamers," the pattern a "streamer pattern" and the image velocity the "streamer velocity." It is shown that the streamer pattern provides an indication of aiming point, and that the streamer velocity provides an indication of proximity to ground. The reason why the pilot does not move his eyeballs is that it is easier to judge streamer-patterns and velocities if he keeps his eyes fixed. A number of very important conclusions, based on this theory, were given in this paper.

Bath and Bristol Centre

The Bath and Bristol Centre held their annual luncheon at the Grand Hotel, Bristol on April 21, when the President and Secretary of the I.E.S. were present. Also present were Alderman W. S. Lewis, the Lord Mayor of Bristol and the Mayor of Bath.

Following the lunch, the toast of City and County of Bristol was proposed by Alderman Lewis, who referred to the difficult job of reconstructing the city following the war. The Lord Mayor of Bristol, in reply, said that although Bristol regretted very much the things which were lost during the war, they first and foremost looked towards the future. He said that he was very glad to be present at this luncheon of the I.E.S. and said he was of the firm opinion that lighting should be used in the future to make new cities more attractive than the old. He asked that the knowledge of the members of the I.E.S. should be used to the advantage of all.

Mr. H. Midgley, Deputy Chairman of the South Western Electricity Board, proposed the toast of the Society. In reply, Dr. J. N. Aldington said that we lived in an age of great inventions, including light sources and fittings, which had many scientific and technical advantages, some of which we have not yet learned how to use. In the lighting field there was much to be done to improve the lighting of our schools and homes—those responsible for erecting schools and houses had yet to be educated in the right use of lighting. The science of street lighting had advanced considerably, and the present high rate of accidents at night could be greatly reduced if only the administrators could overcome their financial difficulties as the technicians had overcome their technical problems.

Mr. A. N. Irens proposed the toast of the Visitors, many of whom had travelled great distances to be present. The reply was made by the Mayor of Bath, who said how much his city appreciated the work of the Society and how glad they were that the city was adequately represented amongst the Groups and Centres.

Leeds Centre

The March sessional meeting of the Centre was held in the Lighting Service Bureau Lecture Theatre, and a paper entitled "Railway Light Signalling Systems" was read by G. G. F. Halliwell.

The paper covered the developments in railway signalling systems, and the author illustrated with the aid of diagrams the electrical circuits in use to-day. Everything connected with signalling must be carefully tested and interlocked to prevent the possibility of failure, and, at the same time, the human element must be borne in mind. Precise positions of trains are shown on glass screens, and allowance even made for lamp failures behind these screens. The very latest practice now being adopted is in the use of plastic screens, which have to be carefully designed. The tendency has been to assist the engine-driver in every way possible, and this point was appreciated when the author produced a picture on the screen showing a stretch of line as it was, and then as it is to-day. The first picture showed a mass of steel structures with numerous signals erected on them, whereas the second showed one isolated pillar in the centre of the track with all the steel structures removed. The author explained that this one unit can direct the driver more efficiently than the numerous signals previously used.

A discussion followed which was opened by Mr. G. M. Smith, who asked the author to explain what would happen if certain specific failures occurred. Concern was felt for the signalman, who was now controlling far more traffic than before. Questions were also asked regarding the possibility of using electronic devices and whether any sections of line are entirely automatically controlled.

Colour Matching Exhibition at Leeds

An exhibition of colour matching lighting equipment was held at the Priestley Hall, City-square, Leeds, on Wednesday to Friday, March 29 to 31.

The exhibition was arranged by the Wool Industries Research Association in conjunction with the Leeds Centre of the Illuminating Engineering Society. The purpose of the exhibition was to demonstrate to dyers and other colour users the different types of daylight colour matching lamps which are normally available. The view having been expressed that there are differences between the colour rendering properties of the main types of colour matching lamps, tests were carried out on a scientific basis in order that these differences may be assessed.

A small number of samples of dyed cloth were used, specially selected for the spectral distribution of their colours, but without in

any way being in the nature of trick dyes. Each sample had its counterpart of two near matches, such as a dyer would make in practice and all visitors were asked to compare these under the different lamps and in daylight from a north window. By the use of matt black cubicles and arranging for equal illuminations on the viewing table with each type of lamp conditions were equalised as far as possible.

At the invitation of the I.E.S., various manufacturers loaned demonstration equipment. This fell into three main categories:—

(1) Straightforward fluorescent lamps of both hot and cold cathode types.

(2) Blended fluorescent and tungsten filament lamp units, including examples of both hot and cold cathode fluorescent lamps.

(3) Tungsten filament lamps with colour filters. In this category there was a special exhibit of United States manufacture which is not generally available in this country, the loan of this unit having been arranged by the Wool Industries Research Association.

The differential colour rendering of the samples in the various lights was recorded by each visitor, and, from an analysis of all these returns by skilled observers, it is anticipated that authoritative findings can be made.

Not only manufacturers of wool, cotton, and artificial silk textiles, but also such things as paint, leather, linoleum and buttons attended from all parts of the country. Buyers of textiles also showed interest, and altogether 412 visitors were recorded.

As an additional feature of the exhibition a colour vision survey was arranged. This was to investigate the variations in normal colour vision of the type associated with the remark that "one sees 'redder' as one becomes older." In particular, it was desired to see how much this variation is among actual colour matchers as compared with, say, the difference between sunlight and north daylight. Since these differences vary with age, visitors were particularly asked to state this and also their occupation. Using a standard I.C.I. illuminant, visitors were asked to select the best match on a graded strip of colour against a reference colour of similar texture. When the results are analysed they should constitute the most comprehensive survey so far made in the variation between individuals of the yellow pigmentation of the eye.

Two lectures were given in support of this exhibition at the Leeds Lighting Service Bureau on Wednesday and Friday, these were "Artificial Daylight," by Mr. Harry Hewitt, and "Variations in Normal Colour Vision," by Mr. F. L. Warburton.

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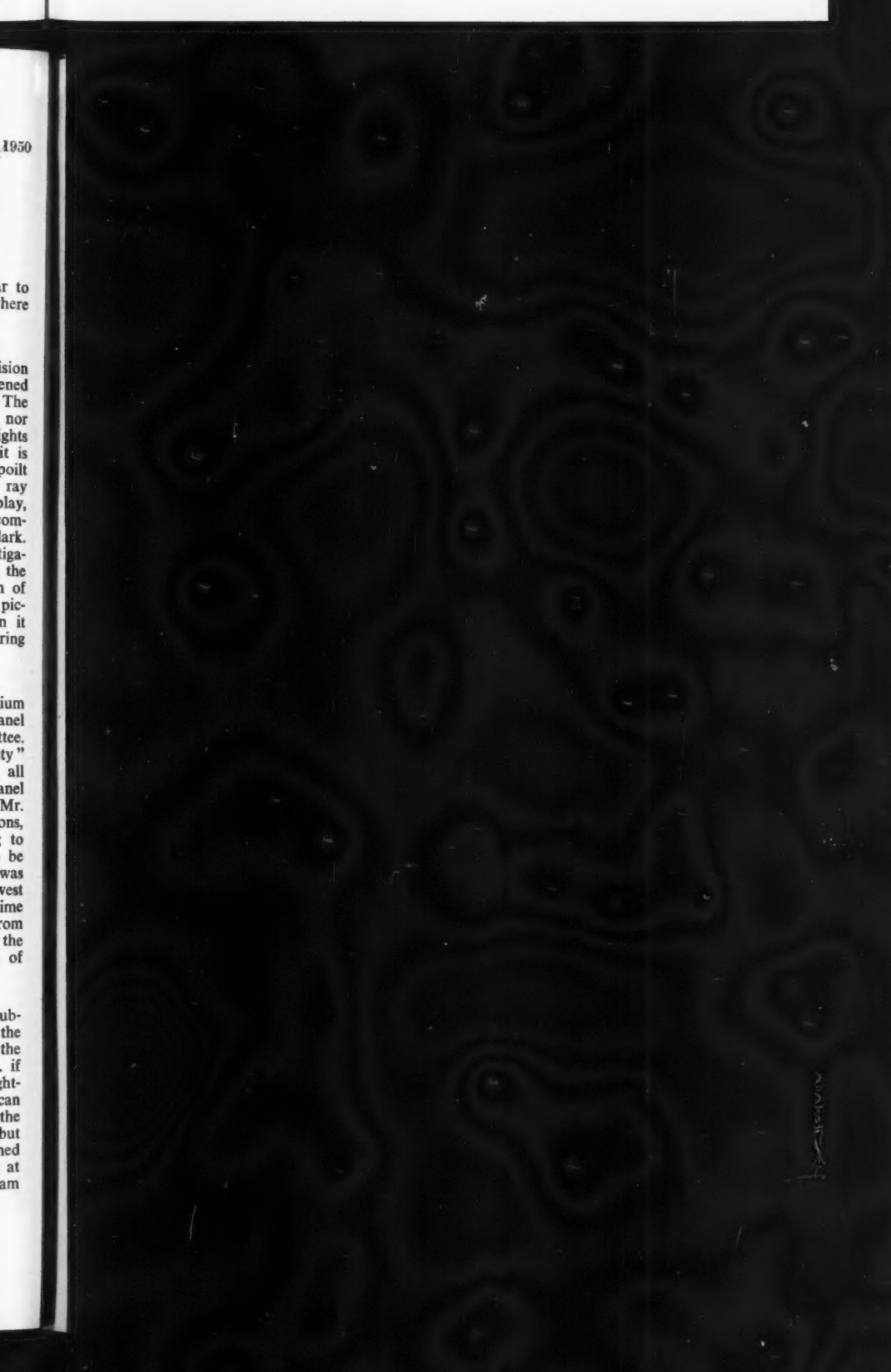
POSTSCRIPT

By "Lumeritas"

A correspondent tells me of an unusual shop lighting installation he noticed recently in Chelsea. The "fittings," he says, were large inverted sunshades, but he was not very favourably impressed by the "soft" lighting produced in this unexpected manner. He wonders whether an installation of this kind conforms with the I.E.S. Code. As to values of illumination possibly it does not, but it is probably free from glare. The I.E.S. Code is not, of course, concerned with the aesthetics of lighting equipment; and, providing sufficient illumination is obtained on objects which ought to be made easily visible, and that a comfortable, physiologically satisfactory, distribution of luminance is secured over the whole interior that fills out the visual field, there is no reason why sunshades or any other adaptable objects should not be improvised as "fittings" if these are what the user likes. Of course, a shopkeeper cannot afford to gratify his own taste if this repels potential customers, but in order to attract them it is sometimes necessary to adopt a method of lighting which is not the most efficient.

I notice that Julia Cairns, author of a new book entitled "Home Making," stresses the importances of good lighting by day and by night. Especially in writing of the guest room (destined to extinction if rationing, lack of domestic helps and penal taxation continue!) she makes the point that good lighting contributes much to the comfort and enjoyment of guests of either sex. Self-inspection is one of the principal "visual tasks" performed in the guest room and, for this purpose, a good light by day involves, as the author says, the careful placing of mirrors in relation to the windows; and how often "mine host" fails to realise this! The author goes on to say, "By good lighting at night I do not mean harsh lighting. No, but there should be some available true lighting — a point which women guests in particular will appreciate — as it will help them to dress with comfort and accuracy. The discomfort of not quite knowing if we have been too free-handed with powder, too liberal with lipstick, can be acute." Unfortunately, it is not clear what is meant by "true lighting." On cosmetic grounds the colour rendering of the light should be similar to that of the light in the living rooms where the guests will be "on view."

Several prospective owners of television receivers have asked me whether a darkened room is necessary when "looking-in." The answer is that it is neither necessary nor desirable to put out all the room lights during a television "session," though it is fairly obvious that the picture will be spoilt by strong direct lighting of the cathode ray tube screen. Viewing a television display, or pictures on a cinema screen, is uncomfortable when the surrounds are too dark. In the case of cinema theatres, an investigation undertaken by the I.E.S. before the recent war showed that the illumination of auditoriums during the showing of the picture could be substantially higher than it generally is, without noticeably impairing the contrasts in the picture.

Another study of cinema auditorium lighting has been made recently by a Panel acting for a British Standards Committee. This was concerned with the "safety" lighting which must be provided in all cinema theatres. The findings of this Panel are reported by one of its members, Mr. J. S. Smyth, in the I.E.S. Transactions, published last month. It is interesting to note that safe movement was found to be possible when the average illumination was only 0.025 lm./ft.^{2} — about the lowest illumination for cone vision — after a time lag of only five seconds for adaptation from the previous level of illumination due to the "maintained" lighting and to diffusion of light by the illuminated screen.

In a recent edition of the American publication "Illuminating Engineering" the authors of a paper in their reply to the discussion "offer their apologies to . . . if he believes that we have sold quality lighting down the river." Having seen American films I know that the expression "up the river" refers to some penal institution; but what is there down the river to be ashamed of? There is probably quality lighting at the former place, so why not downstream as well?